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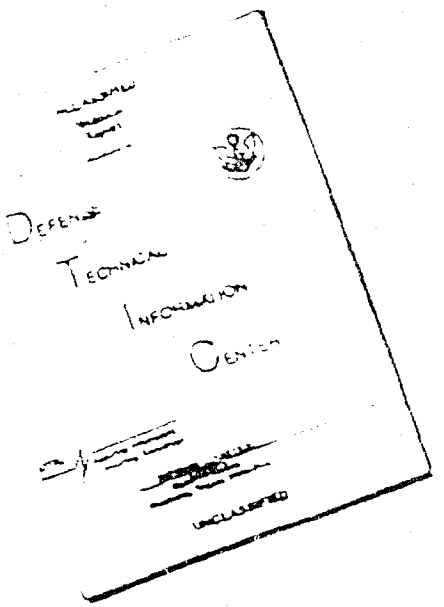

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AFATL-TR-72-75
BOOK 2

AD908927

BALLUTE STABILIZATION FOR VARIOUS MUNITION CONFIGURATIONS

GOODYEAR AEROSPACE CORPORATION

TECHNICAL REPORT AFATL-TR-72-75 BOOK 2
APRIL 1972

AIR FORCE ARMAMENT LABORATORY
AIR FORCE SYSTEMS COMMAND • UNITED STATES AIR FORCE
EGLIN AIR FORCE BASE, FLORIDA

Ballute Stabilization For Various Munition Configurations

J. J. Graham

FOREWORD

This project was conducted by the Goodyear Aerospace Corporation, Akron, Ohio, under Contract F08635-70-C-0050 with the Air Force Armament Laboratory, Eglin Air Force Base, Florida. This effort was conducted during the period from 18 December 1969 to 30 April 1972. The program monitor for the Armament Laboratory was Captain Mark O. Schlegel (DLDL).

This technical report has been reviewed and is approved.

DALE M. DAVIS
Director, Guns and Rockets Division

ABSTRACT

One hundred and nineteen Ballute stabilized bomb configurations were studied to determine the feasibility of ram air-inflated Ballutes as stabilizers or decelerators for various tactical missions. Both subsonic and transonic wind tunnel tests were conducted to define static and dynamic aerodynamic characteristics.

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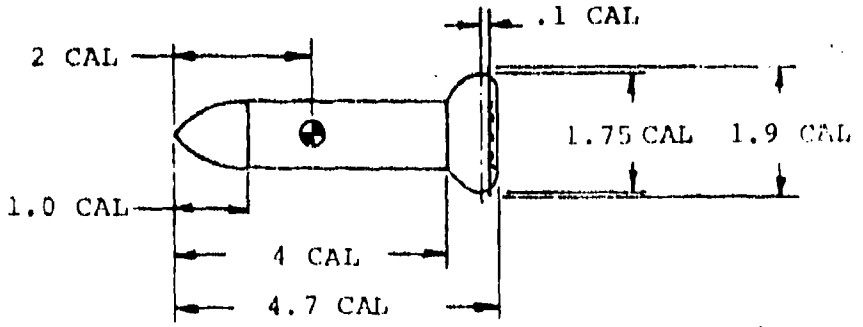

General data

Model weight	=	not applicable
Moment of inertia	=	not applicable

Description of components

Nose shape	=	1.0 caliber ogive
Tripper	=	none
Fineness ratio	=	4.0 caliber
Stabilizer	=	see sketch
Barble fence	=	see sketch
Boattail	=	none
Strakes (8)	=	none

Remarks

Figure 206. Model Specifications for Configuration 96

TABLE CX. STATIC AERODYNAMIC TEST DATA: CONFIGURATION 96

VELOCITY(FT/SEC)	= 200.06	REFERENCE LENGTH(FT)	=0.1250
DENSITY(SLUGS/CU FT)	=0.002467	REFERENCE AREA(SQ FT)	=0.0123
DYNAMIC PRESSURE(LBS/SQ FT)	= 49.34	C.G.(CALIBERS)	=4.000
REYNOLDS NUMBER	=0.1575E 06	ALPHA SHIFT(DEGREES)	= 1.000

ALPHA (DEGREES) SET	ALPHA (DEGREES) TRUE	CL	CD	CN	CA	CM	SM (CALIBERS)
-5.0	-4.0	-0.264	0.733	-0.332	0.767	0.338	0.306
-4.0	-3.0	-0.248	0.760	-0.300	0.741	0.279	-0.673
-3.0	-2.0	-0.149	0.743	-0.187	0.735	0.212	-0.611
-2.0	-1.0	-0.116	0.760	-0.142	0.755	0.185	-0.424
-1.0	0.0	0.0	0.760	-0.013	0.760	0.114	-0.912
0.0	1.0	0.050	0.727	0.050	0.727	0.010	-6.565
1.0	2.0	0.058	0.775	0.063	0.775	0.020	0.294
2.0	3.0	0.149	0.793	0.176	0.787	0.035	0.560
3.0	4.0	0.132	0.775	0.173	0.768	0.062	-2.175
4.0	5.0	-0.182	0.793	0.237	0.778	-0.010	-0.041
5.0	6.0	0.215	0.809	0.284	0.786	-0.014	-0.051
6.0	7.0	0.281	0.809	0.364	0.776	-0.082	-0.227
7.0	8.0	0.330	0.809	0.427	0.763	-0.128	-0.300
8.0	9.0	0.446	0.826	0.557	0.756	-0.179	-0.321
9.0	10.0	0.512	0.859	0.640	0.768	-0.254	-0.397
10.0	11.0	0.694	0.842	0.829	0.709	-0.343	-0.413
11.0	12.0	0.661	0.908	0.822	0.766	-0.379	-0.460
12.0	13.0	0.760	0.925	0.930	0.747	-0.428	-0.458
13.0	14.0	0.793	0.942	0.984	0.739	-0.454	-0.461
14.0	15.0	0.826	0.941	1.041	0.762	-0.485	-0.447
15.0	16.0	0.942	1.024	1.174	0.745	-0.563	-0.479
16.0	17.0	0.959	1.008	1.199	0.705	-0.647	-0.540
17.0	18.0	0.958	1.057	1.225	0.741	-0.701	-0.572
18.0	19.0	0.991	1.024	1.259	0.669	-0.760	-0.603
19.0	20.0	1.057	1.033	1.356	0.687	-0.841	-0.621
20.0	21.0	1.140	1.090	1.444	0.645	-0.842	-0.583

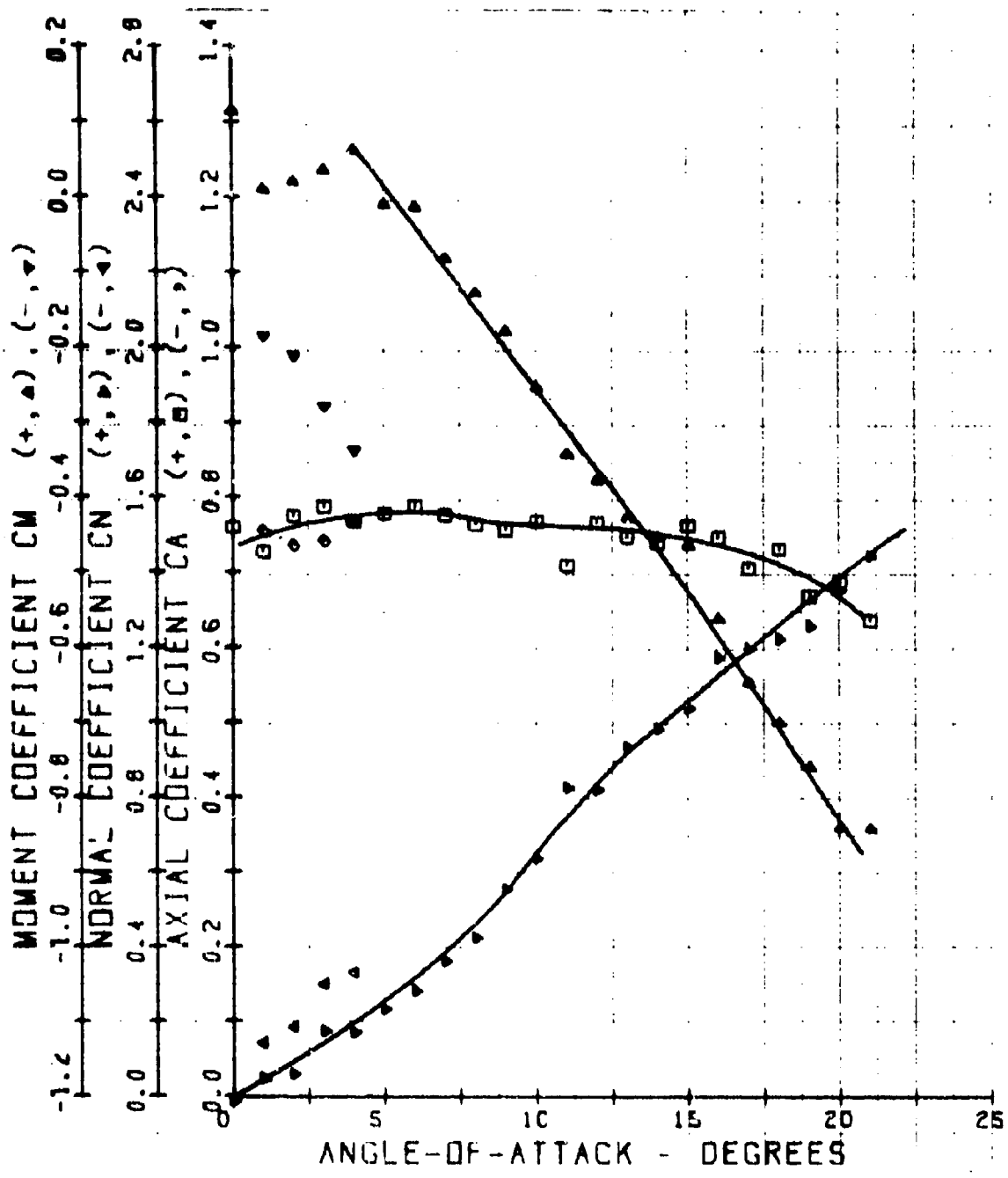

Figure 207. Graphic Static Aerodynamic Test Data: Configuration 96 (Test No. E 1)

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Static aerodynamic data	
Tabulated	339
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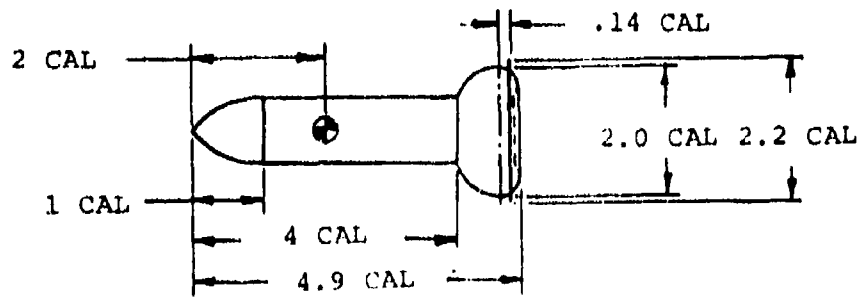
Dynamic stability data	
Tabulated	
Plotted	



General data

Model weight	=	not applicable
Moment of inertia	=	not applicable

Description of components

Nose shape	=	1.0 caliber ogive
Tripper	=	none
Fineness ratio	=	4.0 caliber
Stabilizer	=	see sketch
Burble fence	=	see sketch
Boattail	=	none
Strakes (8)	=	none

Remarks

Figure 208. Model Specification for Configuration 97

TABLE CXI. STATIC AERODYNAMIC TEST DATA: CONFIGURATION 97

VELOCITY(FT/SEC)	= 200.00	REFERENCE LENGTH(FT)	=0.1250
DENSITY(SLUGS/CU FT)	=0.002467	REFERENCE AREA(SQ FT)	=0.0123
DYNAMIC PRESSURE(LBS/SQ FT)	= 49.52	X-CG(CALIBERS)	=4.0000
REYNOLDS NUMBER	=0.1930E+06	ALPHA SHIFT(DEGREES)	= 2.200

ALPHA (DEGREES) SET	ALPHA (DEGREES) MODEL	CL	CD	CN	CA	CM	SM (CALIBERS)
-5.0	-2.8	-0.197	1.201	-0.301	1.180	0.175	-0.468
-4.0	-1.8	-0.099	1.159	-0.180	1.159	0.025	0.356
-3.0	-0.8	-0.115	1.214	-0.179	1.210	-0.074	-0.549
-2.0	0.2	0.049	1.189	0.079	1.196	-0.117	-0.376
-1.0	1.2	0.099	1.234	0.077	1.236	-0.196	-0.271
0.0	2.2	0.098	1.234	0.092	1.234	-0.239	-1.984
1.0	3.2	0.099	1.218	0.120	1.216	-0.280	11.053
2.0	4.2	0.080	1.185	0.124	1.181	-0.228	-0.975
3.0	5.2	0.197	1.201	0.267	1.189	-0.433	-1.664
4.0	6.2	0.214	1.218	0.293	1.200	-0.525	-1.759
5.0	7.2	0.287	1.251	0.388	1.222	-0.578	-1.491
6.0	8.2	0.362	1.185	0.489	1.141	-0.675	-1.395
7.0	9.2	0.446	1.267	0.644	1.198	-0.807	-1.253
8.0	10.2	0.543	1.234	0.713	1.147	-0.845	-1.191
9.0	11.2	0.592	1.267	0.783	1.159	-0.963	-1.229
10.0	12.2	0.709	1.317	0.929	1.174	-1.065	-1.150
11.0	13.2	0.823	1.382	1.071	1.200	-1.236	-1.153
12.0	14.2	0.889	1.413	1.164	1.200	-1.376	-1.183
13.0	15.2	0.905	1.448	1.208	1.208	-1.449	-1.200
14.0	16.2	1.037	1.459	1.363	1.176	-1.543	-1.134
15.0	17.2	1.077	1.465	1.412	1.184	-1.652	-1.170
16.0	18.2	1.173	1.469	1.532	1.113	-1.805	-1.260
17.0	19.2	1.191	1.530	1.583	1.190	-1.880	-1.198
18.0	20.2	1.271	1.535	1.736	1.197	-1.945	-1.189
19.0	21.2	1.234	1.613	1.677	1.129	-2.080	-1.241
20.0	22.2	1.334	1.646	1.781	1.085	-2.089	-1.141

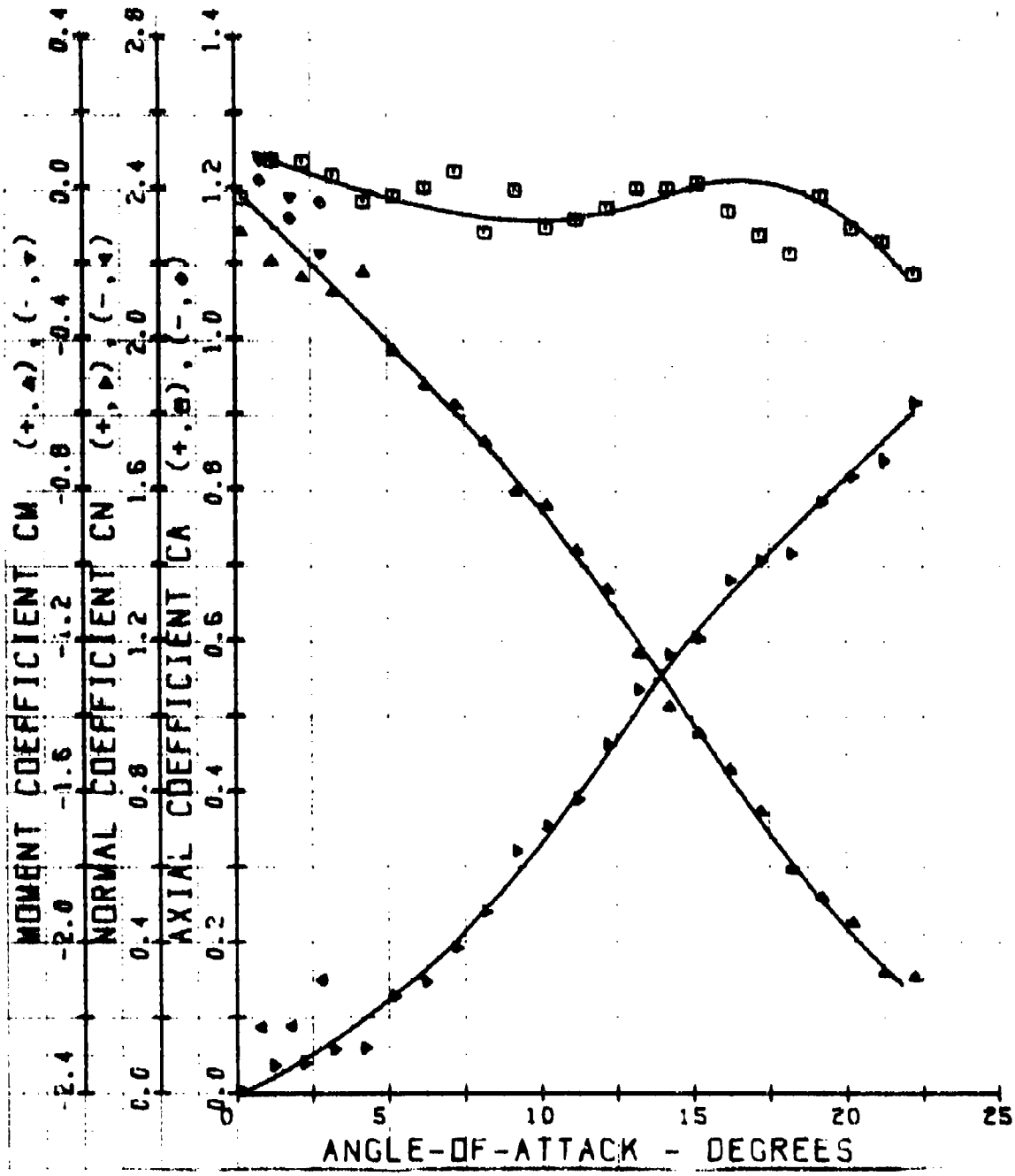


Figure 209. Graphic Static Aerodynamic Test Data Configuration 97 (Test No. E 2)

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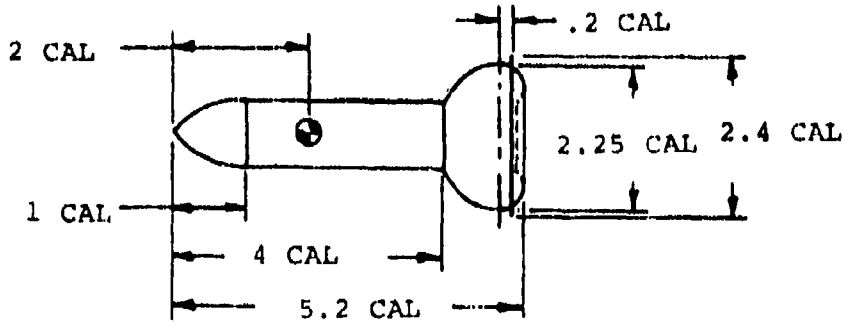
Dynamic stability data	
Tabulated	
Plotted	



General data

Model weight = not applicable
Moment of inertia = not applicable

Description of components

Nose shape = 1.0 caliber ogive
Tripper = none
Fineness ratio = 4.0 caliber
Stabilizer = see sketch
Burble fence = see sketch
Boattail = none
Strakes (8) = none

Remarks

Figure 210. Model Specifications for Configuration 98

TABLE CXII. STATIC AERODYNAMIC TEST DATA: CONFIGURATION 98

VELOCITY(FT/SEC)	= [illegible]	REFERENCE LENGTH(FT)	=0.1250
DENSITY(SLUGS/CU FT)	=0.[illegible]2431	REFERENCE AREA(SQ FT)	=0.0123
DYNAMIC PRESSURE(LBS/SQ FT)	= [illegible]	C.G.(CALIBERS)	=4.0000
REYNOLDS NUMBER	=[illegible]	ALPHA SHIFT(DEGREES)	= 2.200

ALPHA (DEGREES) SET	ALPHA (DEGREES) TRUE	CL	CD	CN	CA	CM	SM (CALIBERS)
-5.0	-2.8	-0.279	2.447	-0.491	2.414	1.034	16.345
-4.0	-1.8	-0.181	2.332	-0.343	2.314	1.012	-1.831
-3.0	-0.8	0.0	2.102	-0.119	2.099	0.531	-1.889
-2.0	0.2	0.082	2.152	0.007	2.153	0.297	-12.802
-1.0	1.2	0.0	2.283	-0.049	2.283	0.116	0.826
0.0	2.2	-0.034	2.251	-0.033	2.250	0.214	1.606
1.0	3.2	0.016	2.267	0.056	2.266	0.208	-22.417
2.0	4.2	0.016	2.267	0.096	2.265	-0.098	-0.774
3.0	5.2	0.394	2.184	0.503	2.161	-0.181	-0.355
4.0	6.2	0.411	2.217	0.564	2.183	-0.429	-0.760
5.0	7.2	0.494	2.332	0.596	2.289	-0.607	-1.019
6.0	8.2	0.460	2.297	0.699	2.239	-0.777	-1.114
7.0	9.2	0.476	2.250	0.747	2.175	-0.941	-1.260
8.0	10.2	0.558	2.283	0.871	2.183	-0.929	-1.067
9.0	11.2	0.838	2.283	1.184	2.124	-1.484	-1.253
10.0	12.2	0.867	2.217	1.258	2.030	-1.579	-1.255
11.0	13.2	1.068	2.217	1.471	1.973	-1.737	-1.181
12.0	14.2	1.151	2.234	1.593	1.966	-1.848	-1.238
13.0	15.2	1.134	2.284	1.618	1.977	-2.058	-1.272
14.0	16.2	1.117	2.318	1.644	1.977	-2.020	-1.229
15.0	17.2	1.134	2.251	1.672	1.945	-2.144	-1.146
16.0	18.2	1.234	2.283	1.816	1.957	-2.409	-1.284
17.0	19.2	1.465	2.234	2.035	1.714	-2.501	-1.233
18.0	20.2	1.[illegible]	2.152	1.977	1.622	-2.619	-1.325
19.0	21.2	1.564	2.382	2.251	1.744	-2.751	-1.227
20.0	22.2	1.564	2.349	2.254	1.679	-3.037	-1.347

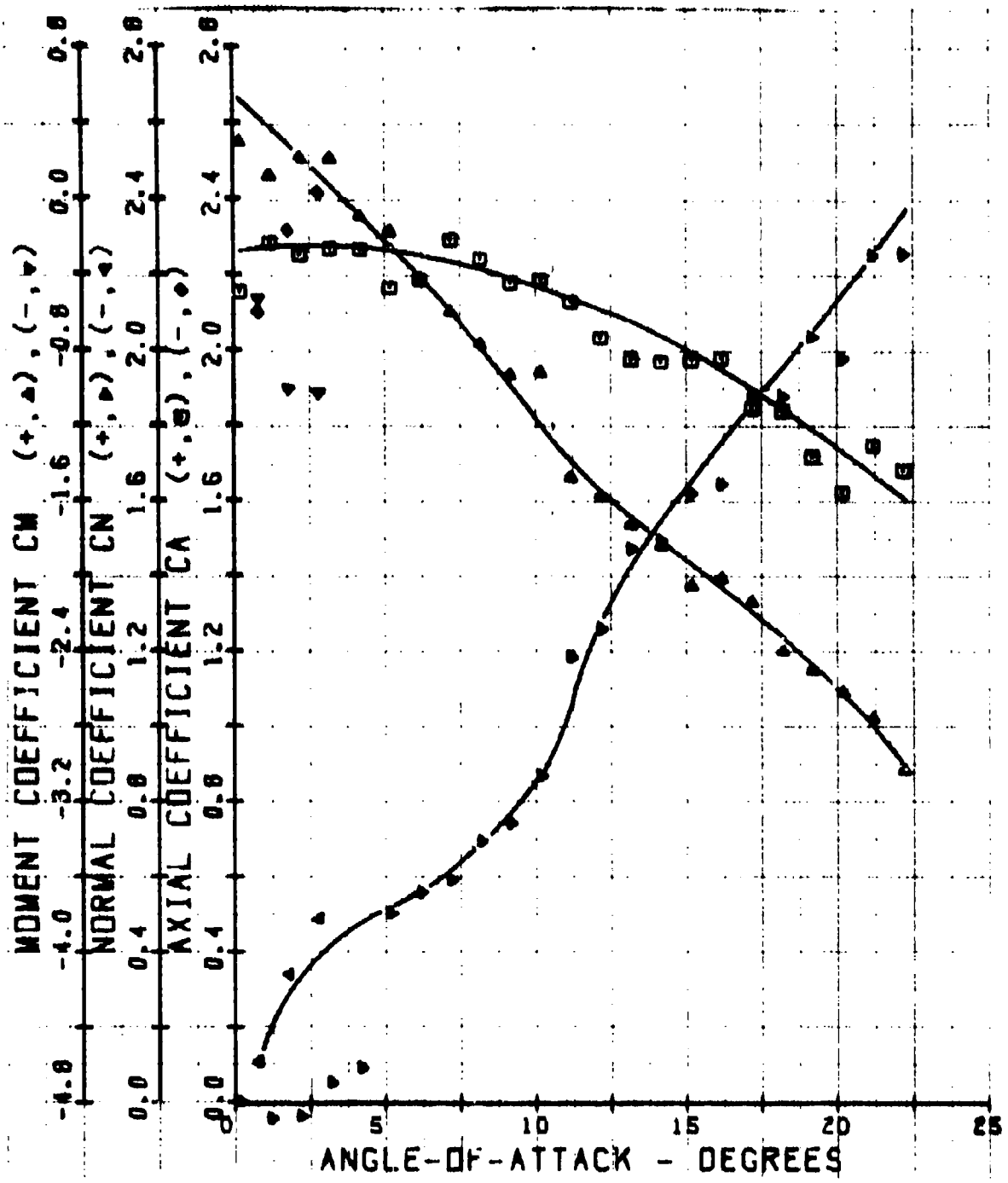


Figure 211. Graphic Static Aerodynamic Test Data: Configuration 98 (Test No. E 3)

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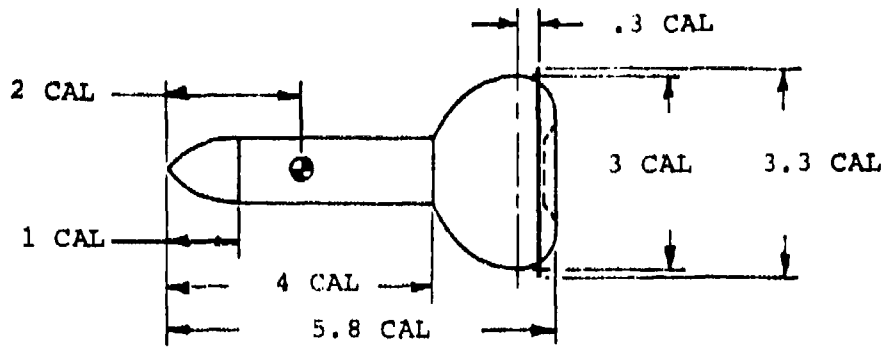
Static aerodynamic data	
Tabulated	345
Plotted	346
Dynamic stability data	
Tabulated	
Plotted	



General data
- Model weight = not applicable
- Moment of inertia = not applicable

Description of components
- Nose shape = 1.0 caliber ogive
- Tripper = none
- Fineness ratio = 4.0 caliber
- Stabilizer = see sketch
- Burble fence = see sketch
- Boattail = none
- Strakes (8) = none

Remarks

Figure 212. Model Specifications for Configuration 99

TABLE CXIII. STATIC AERODYNAMIC TEST DATA: CONFIGURATION 99

VELOCITY(FT/SEC)	= 200.00	REFERENCE LENGTH(FT)	=0.1250
DENSITY(SLUGS/CU FT)	=0.002494	REFERENCE AREA(SQ FT)	=0.0123
DYNAMIC PRESSURE(LBS/SQ FT)	= 49.88	C.G.(CALIBERS)	=4.0000
REYNOLDS NUMBER	=0.1592E 06	ALPHA SHIFT(DEGREES)	= 1.800

ALPHA (DEGREES) SET	ALPHA (DEGREES) TRUE	CL	CD	CN	CA	CM	SM (CALIBERS)
-5.0	-3.2	-0.229	5.735	-0.728	5.693	1.912	2.214
-4.0	-2.2	-0.163	5.735	-0.563	5.710	1.430	-1.584
-3.0	-1.2	0.0	5.686	-0.298	5.678	0.781	-28.182
-2.0	-0.2	-0.049	5.696	-0.247	5.681	-0.198	-2.931
-1.0	0.8	0.005	5.572	0.507	5.581	-1.613	-1.733
0.0	1.8	0.556	5.817	0.555	5.817	-1.775	-1.545
1.0	2.8	0.817	5.784	0.918	5.769	-2.387	-2.567
2.0	3.8	0.817	5.947	1.024	5.915	-3.142	46.248
3.0	4.8	0.833	5.784	1.135	5.733	-3.584	-1.192
4.0	5.8	1.242	5.915	1.651	5.814	-4.041	-2.447
5.0	6.8	1.291	5.947	1.804	5.812	-4.441	-2.462
6.0	7.8	1.274	6.144	1.910	5.977	-4.854	-2.542
7.0	8.8	1.340	6.176	2.082	5.967	-5.080	-2.440
8.0	9.8	1.356	6.078	2.189	5.830	-11.789	-5.386
9.0	10.8	1.471	6.078	2.403	5.773	-5.669	-2.359
10.0	11.8	1.372	6.029	2.399	5.699	-5.959	-2.485
11.0	12.8	1.307	6.193	2.464	5.829	-6.777	-2.750
12.0	13.8	1.291	6.094	2.529	5.693	-6.710	-2.653
13.0	14.8	1.716	5.931	3.006	5.393	-7.619	-2.535
14.0	15.8	1.863	5.833	3.218	5.209	-7.599	-2.361
15.0	16.8	2.210	5.882	3.463	5.162	-8.266	-2.387
16.0	17.8	2.189	5.784	3.699	4.957	-9.008	-2.436
17.0	18.8	2.157	5.947	3.801	5.057	-9.260	-2.436
18.0	19.8	2.189	5.784	3.869	4.825	-9.418	-2.434
19.0	20.8	2.435	5.849	4.206	4.738	-9.915	-2.357
20.0	21.8	2.467	5.882	4.330	4.664	-10.422	-2.407

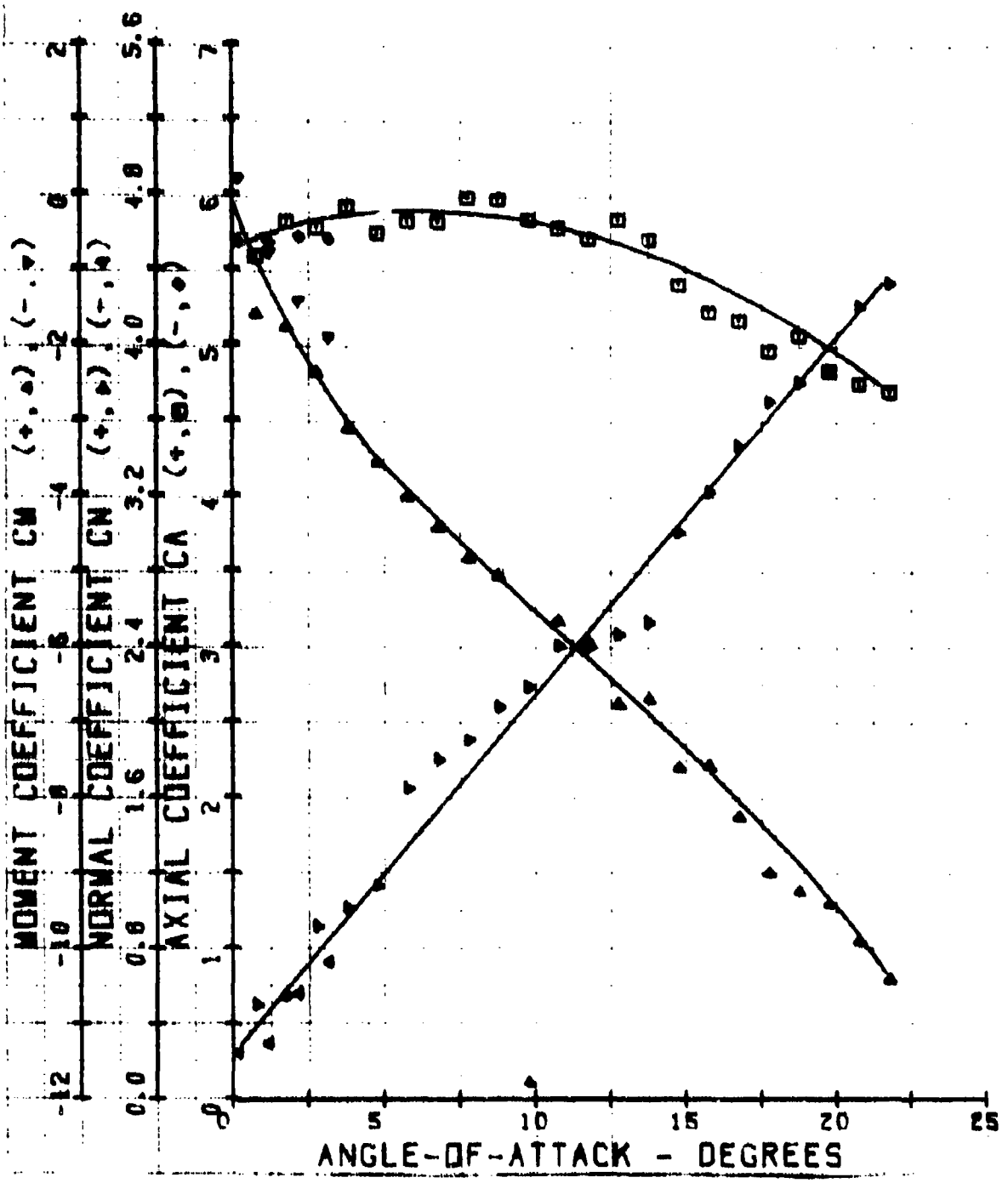


Figure 213. Graphic Static Aerodynamic Test Data: Configuration 99 (Test No. E 4)

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Static aerodynamic data	
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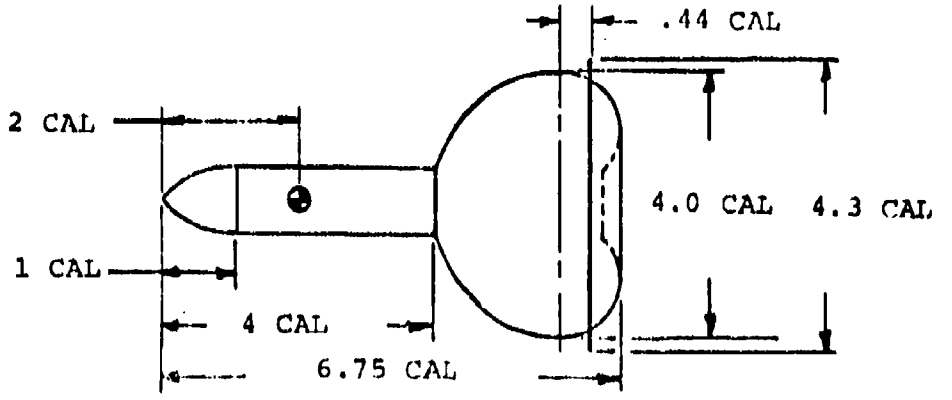
Plotted	349
Dynamic stability data	
Tabulated	
Plotted	



General data
- Model weight = not applicable
- Moment of inertia = not applicable

Description of components
- Nose shape = 1.0 caliber ogive
- Tripper = none
- Fineness ratio = 4.0 caliber
- Stabilizer = see sketch
- Burble fence = see sketch
- Boattail = none
- Strakes (8) = none

Remarks

Figure 214. Model Specifications for Configuration 100

TABLE CXIV. STATIC AERODYNAMIC TEST DATA: CONFIGURATION 100

VELOCITY(FT/SEC) = 200.00 REFERENCE LENGTH(FT) =0.1250
DENSITY(SLUGS/CU FT) =0.002498 REFERENCE AREA(SQ FT) =0.0123
DYNAMIC PRESSURE(LBS/SQ FT) = 47.76 C.G.(CALIBERS) =4.0000
REYNOLDS NUMBER =2.15746 ALPHA SHIFT(DEGREES) =-0.800

ALPHA (DEGREES) SET	TRUE	CL	CD	CN	CA	CM	CM (CALIBERS)
-5.0	-5.8	-1.387	0.417	-2.115	0.265	9.114	-4.309
-4.0	-4.8	-1.387	0.417	-1.970	0.320	8.155	-3.923
-3.0	-3.8	-1.044	0.276	-1.502	0.210	5.448	-2.640
-2.0	-2.8	-0.734	0.248	-1.021	0.207	3.122	-1.752
-1.0	-1.8	-0.489	0.237	-0.634	0.277	3.361	-6.040
0.0	-0.8	-0.359	0.275	-0.359	0.275	1.707	-6.564
1.0	0.2	-0.052	0.320	0.064	0.320	-0.646	-2.265
2.0	1.2	0.0	0.240	0.302	0.041	-0.328	-2.417
3.0	2.2	0.326	0.199	0.754	0.120	-2.622	-3.798
4.0	3.2	0.816	0.483	1.409	0.405	-4.235	-2.925
5.0	4.2	1.060	0.453	1.793	0.326	-6.083	-5.073
6.0	5.2	1.305	0.459	2.181	0.297	-7.069	-3.241
7.0	6.2	1.501	0.385	2.511	0.140	-7.059	-2.911
8.0	7.2	1.223	0.776	2.433	0.521	-8.434	-3.426
9.0	8.2	1.745	0.484	3.051	0.165	-9.152	-3.000
10.0	9.2	1.876	0.401	3.306	0.944	-10.006	-3.026
11.0	10.2	1.713	0.809	3.362	0.320	-10.309	-3.067
12.0	11.2	1.876	0.434	3.598	0.917	-11.543	-3.208
13.0	12.2	2.088	0.403	3.942	0.776	-12.207	-3.094
14.0	13.2	2.613	0.484	4.599	0.670	-13.916	-2.948
15.0	14.2	2.610	0.443	4.716	0.519	-14.166	-3.004
16.0	15.2	2.773	0.434	5.004	0.337	-15.472	-3.092
17.0	16.2	2.936	0.520	5.248	0.078	-16.741	-3.190
18.0	17.2	3.067	0.646	5.513	0.265	-17.963	-3.189
19.0	18.2	3.263	0.320	5.793	0.305	-18.917	-3.266
20.0	19.2	3.752	0.320	6.571	0.535	-19.794	-3.167

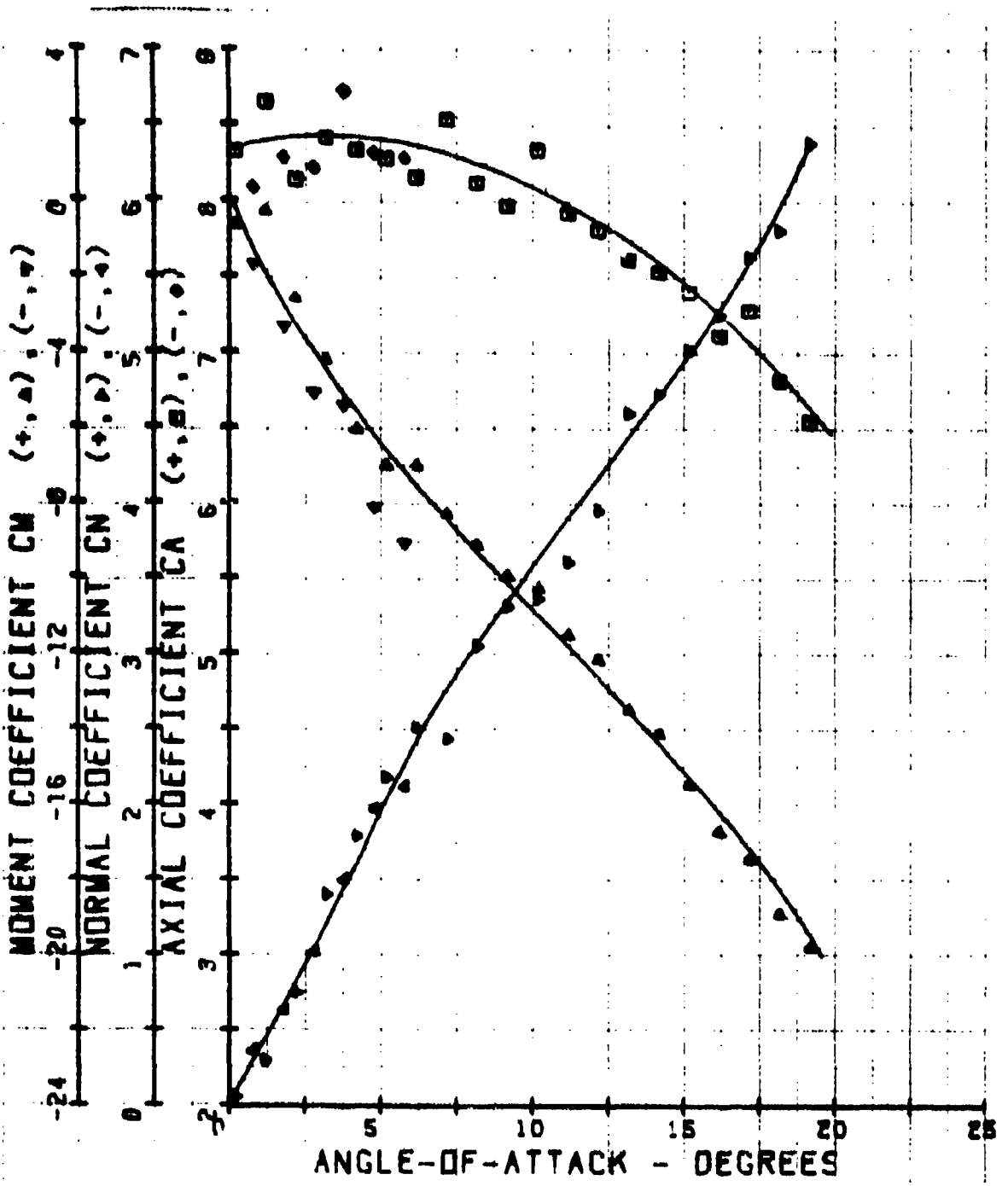
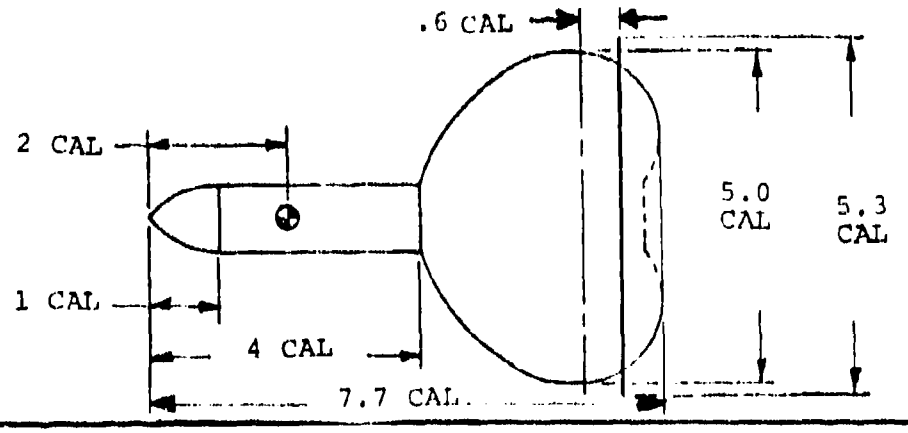


Figure 215. Graphic Static Aerodynamic Test Data: Configuration 100.
(Test No. E 5)

Item	Page
Static aerodynamic data	
Tabulated	351
Plotted	352
Dynamic stability data	
Tabulated	
Plotted	



General data

Model weight = not applicable
Moment of inertia = not applicable

Description of components

Nose shape = 1.0 caliber ogive
Tripper = none
Fineness ratio = 4.0 caliber
Stabilizer = see sketch
Burble fence = see sketch
Boattail = none
Strakes (8) = none

Remarks

Figure 216. Model Specifications for Configuration 101

TABLE CXV. STATIC AERODYNAMIC TEST DATA: CONFIGURATION 101

VELOCITY(FT/SEC)	= 200.00	REFERENCE LENGTH(FT)	=0.1250
DENSITY(SLUGS/CU FT)	=0.002501	REFERENCE AREA(SQ FT)	=0.0123
DYNAMIC PRESSURE(LBS/SQ FT)	= 50.02	C.G.(CALIBERS)	=4.0000
REYNOLDS NUMBER	=0.1596E 06	ALPHA SHIFT(DEGREES)	= 2.800

ALPHA (DEGREES) SET	TRU	CL	CD	CN	CA	CM	SM (CALIBERS)
-5.0	-2.2	-0.652	13.686	-1.842	13.578	7.788	0.054
-4.0	-1.2	-0.183	13.524	-1.106	13.479	5.197	-16.739
-3.0	-0.2	0.163	13.524	-0.545	13.514	0.838	-2.764
-2.0	0.8	1.303	14.338	0.802	14.375	-1.130	-1.722
-1.0	1.8	0.815	13.849	0.573	13.861	-3.171	-24.481
0.0	2.8	1.629	13.849	1.629	13.849	-7.981	1.384
1.0	3.8	2.115	14.012	2.362	13.973	-3.255	-2.046
2.0	4.8	2.607	14.664	3.117	14.564	-12.542	-11.106
3.0	5.8	3.422	14.175	4.159	13.977	-18.541	-4.458
4.0	6.8	3.585	14.990	4.621	14.703	-20.248	-4.382
5.0	7.8	2.444	14.990	3.741	14.720	-20.859	-5.576
6.0	8.8	3.910	15.153	5.473	14.661	-25.720	-4.700
7.0	9.8	4.725	14.990	6.516	14.303	-25.923	-3.978
8.0	10.8	3.585	14.990	5.695	14.345	-26.752	-4.747
9.0	11.8	4.073	14.990	6.368	14.168	-26.981	-4.237
10.0	12.8	4.725	14.990	7.256	13.942	-29.385	-4.050
11.0	13.8	4.725	15.642	7.622	14.453	-29.311	-3.845
12.0	14.8	4.888	15.316	7.905	13.965	-26.631	-3.343
13.0	15.8	4.073	15.315	7.414	14.007	-29.646	-3.999
14.0	16.8	4.888	15.316	8.447	13.579	-31.618	-3.743
15.0	17.8	4.725	15.968	8.678	14.201	-32.409	-3.727
16.0	18.8	4.725	15.642	8.853	13.734	-33.634	-3.799
17.0	19.8	4.399	15.968	8.875	13.984	-33.045	-3.723
18.0	20.8	4.888	15.316	9.391	13.056	-33.990	-3.623
19.0	21.8	5.051	15.479	9.514	12.992	-35.980	-3.666
20.0	22.8	4.888	15.805	9.998	13.180	-33.874	-3.388

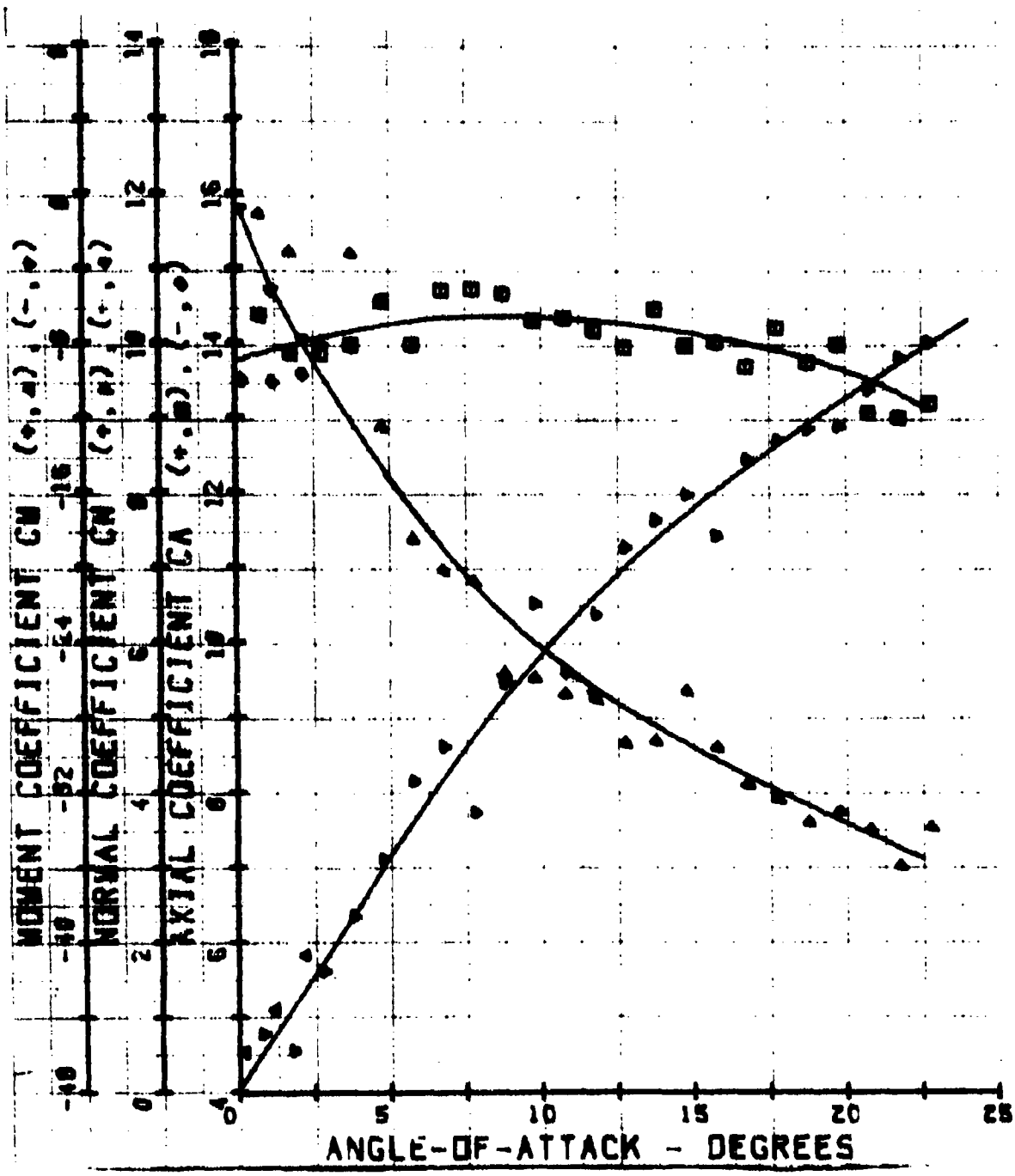
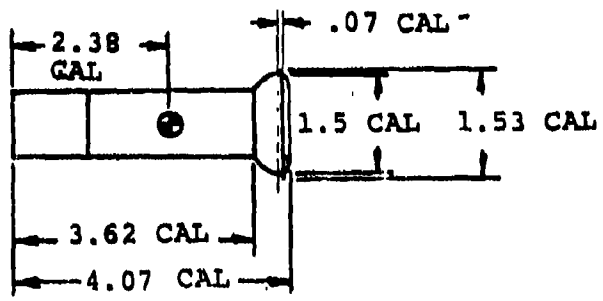


Figure 217. Graphic Static Aerodynamic Test Data: Configuration 101 (Test No. E 6)

Item	Page
Static aerodynamic data	
Tabulated	
Plotted	354
Dynamic stability data	
Tabulated	
Plotted	



General data
- Model weight = not applicable
- Moment of inertia = not applicable

Description of components
- Nose shape = 1.0 caliber ogive
- Tripper = none
- Fineness ratio = 4.0 caliber
- Stabilizer = see sketch
- Burble fence = see sketch
- Boattail = none
- Strakes (8) = none

Remarks

Figure 218. Model Specification for Configuration 102

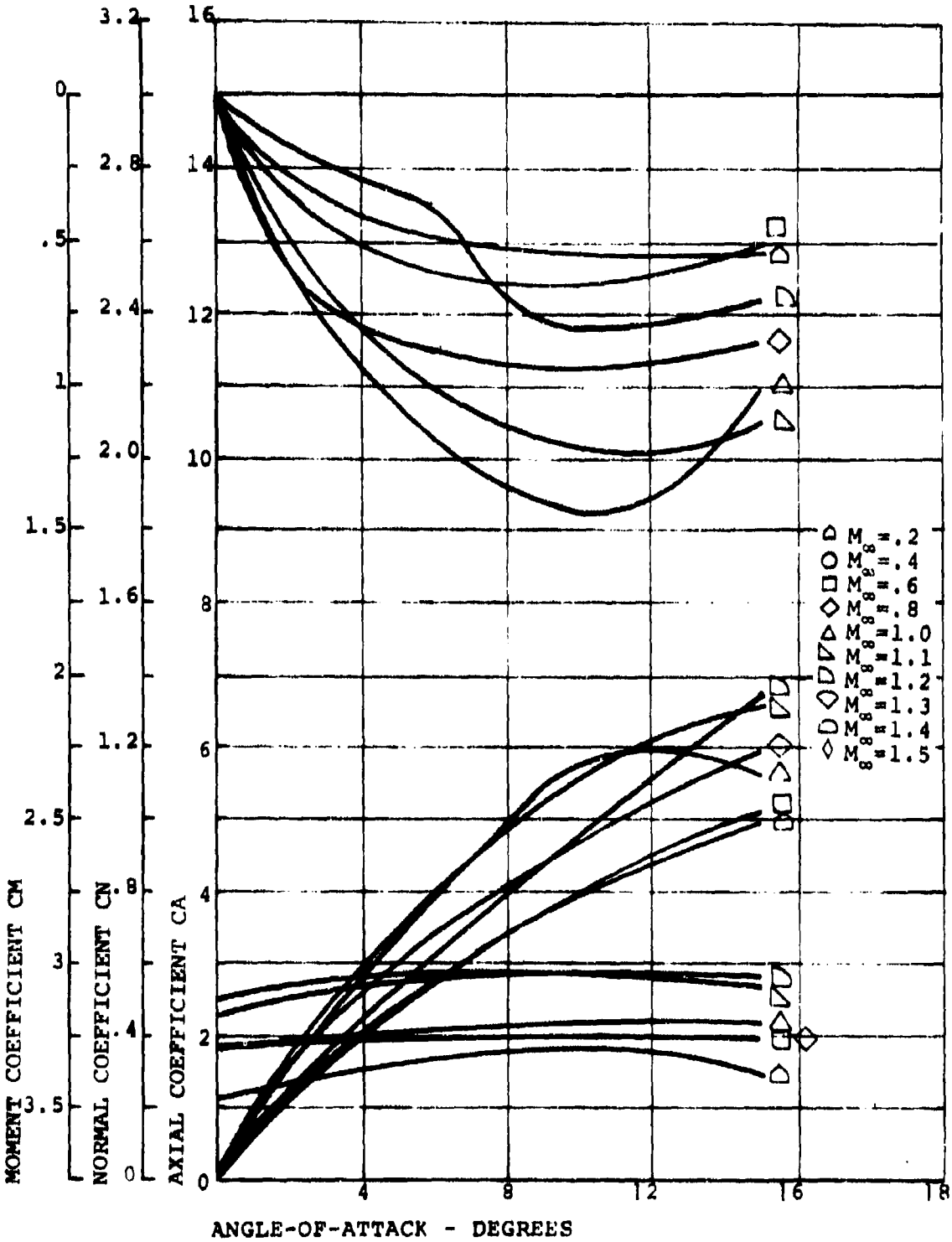
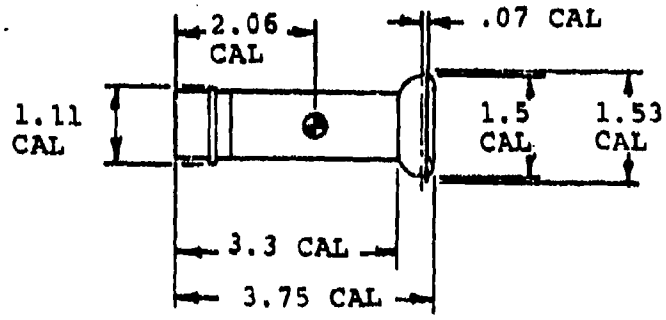


Figure 219. Graphic Static Aerodynamic Test Data: Configuration 102 (Test No. E 7)

Item	Page
Static aerodynamic data	
Tabulated	
Plotted	356
Dynamic stability data	
Tabulated	
Plotted	



General data
- Model weight = not applicable
- Moment of inertia = not applicable

Description of components
- Nose shape = 1.0 caliber ogive
- Tripper = none
- Fineness ratio = 4.0 caliber
- Stabilizer = see sketch
- Burble fence = see sketch
- Boattail = none
- Strakes (8) = none

Remarks

Figure 220. Model Specifications for Configuration 103

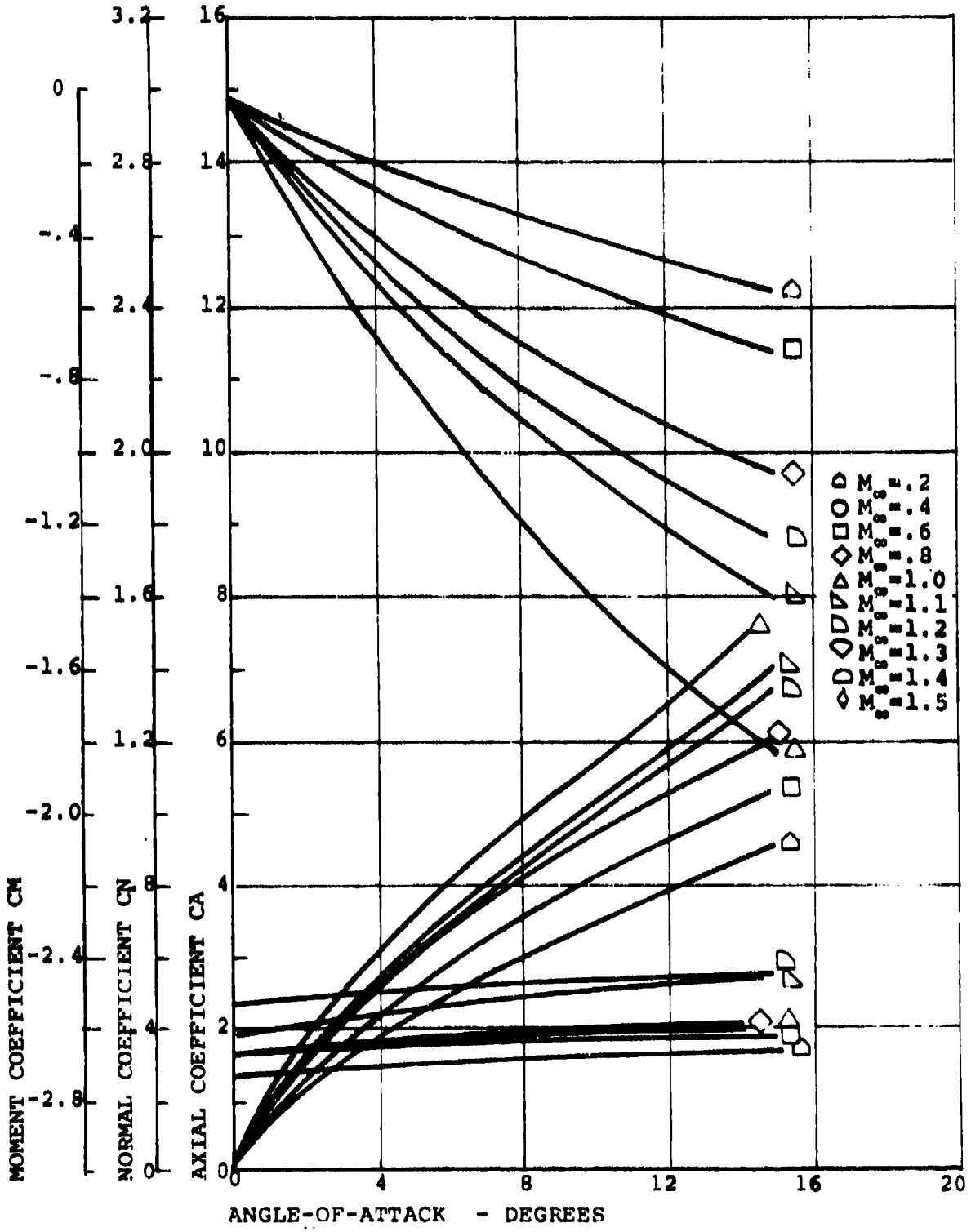
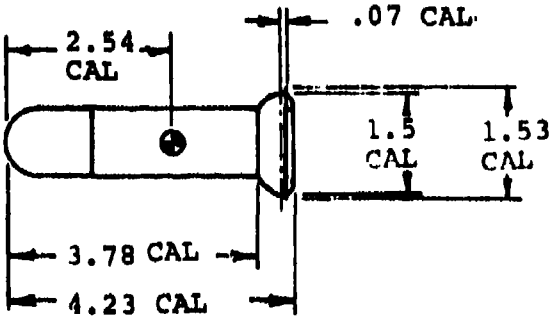


Figure 221. Graphic Static Aerodynamic Test Data: Configuration 103 (Test No. E 8)

Item	Page
Static aerodynamic data	
Tabulated	
Plotted	358
Dynamic stability data	
Tabulated	
Plotted	



General data
- Model weight = not applicable
- Moment of inertia = not applicable

Description of components
- Nose shape = 1.0 caliber ogive
- Tripper = none
- Fineness ratio = 4.0 caliber
- Stabilizer = see sketch
- Burble fence = see sketch
- Boattail = none
- Strakes (8) = none

Remarks

Figure 222. Model Specifications for Configuration 104

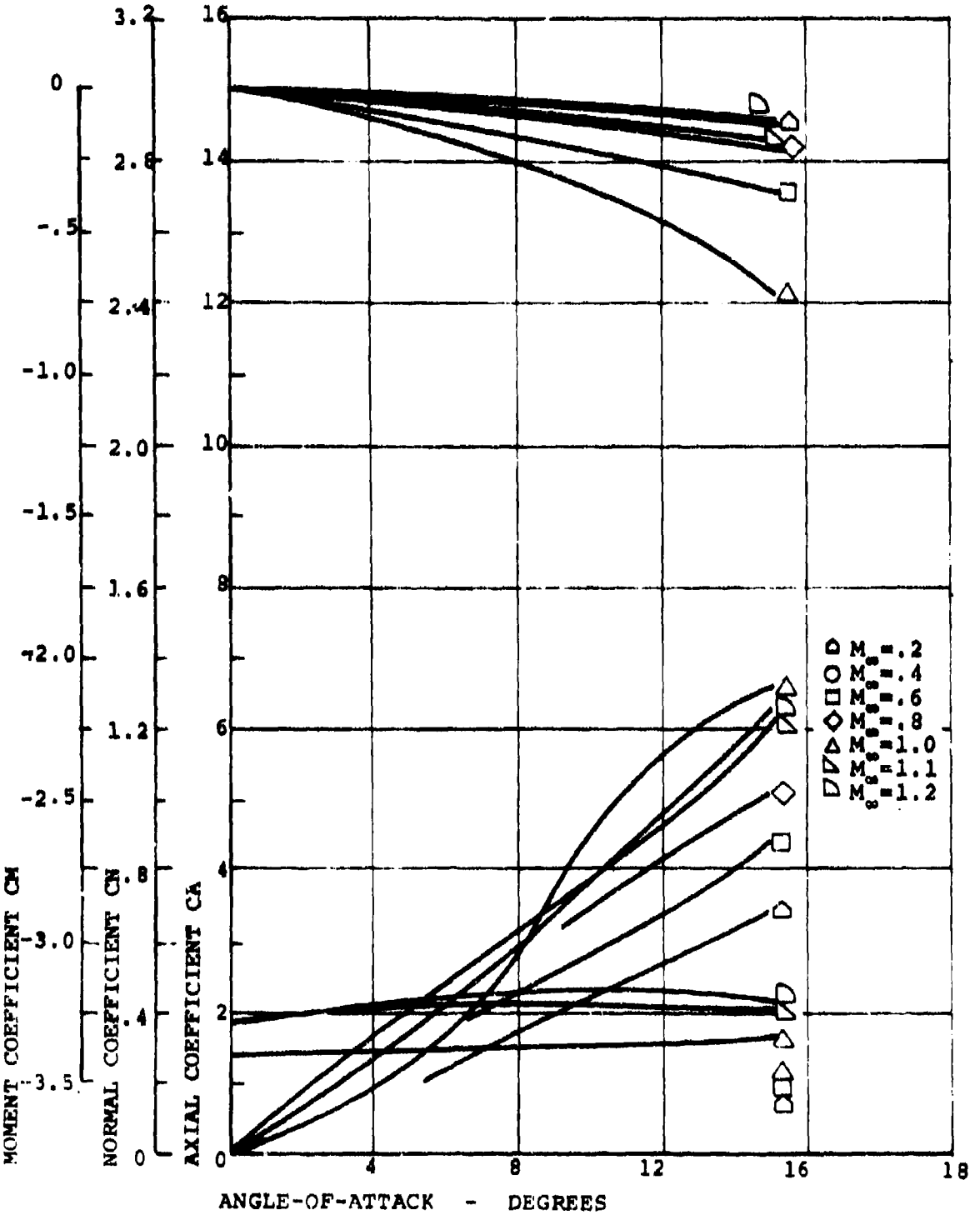
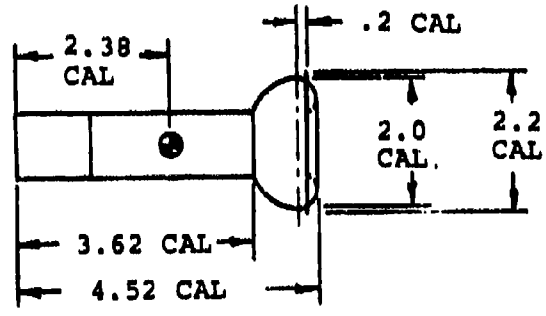


Figure 223. Graphic Static Aerodynamic Test Data: Configuration 104 (Test No. E 9)

Item	Page
Static aerodynamic data	
Tabulated	
Plotted	360
Dynamic stability data	
Tabulated	
Plotted	



General data

Model weight	=	not applicable
Moment of inertia	=	not applicable

Description of components

Nose shape	=	1.0 caliber ogive
Tripper	=	none
Fineness ratio	=	4.0 caliber
Stabilizer	=	see sketch
Burble fence	=	see sketch
Boattail	=	none
Strakes (8)	=	none

Remarks

Figure 224. Model Specification for Configuration 105

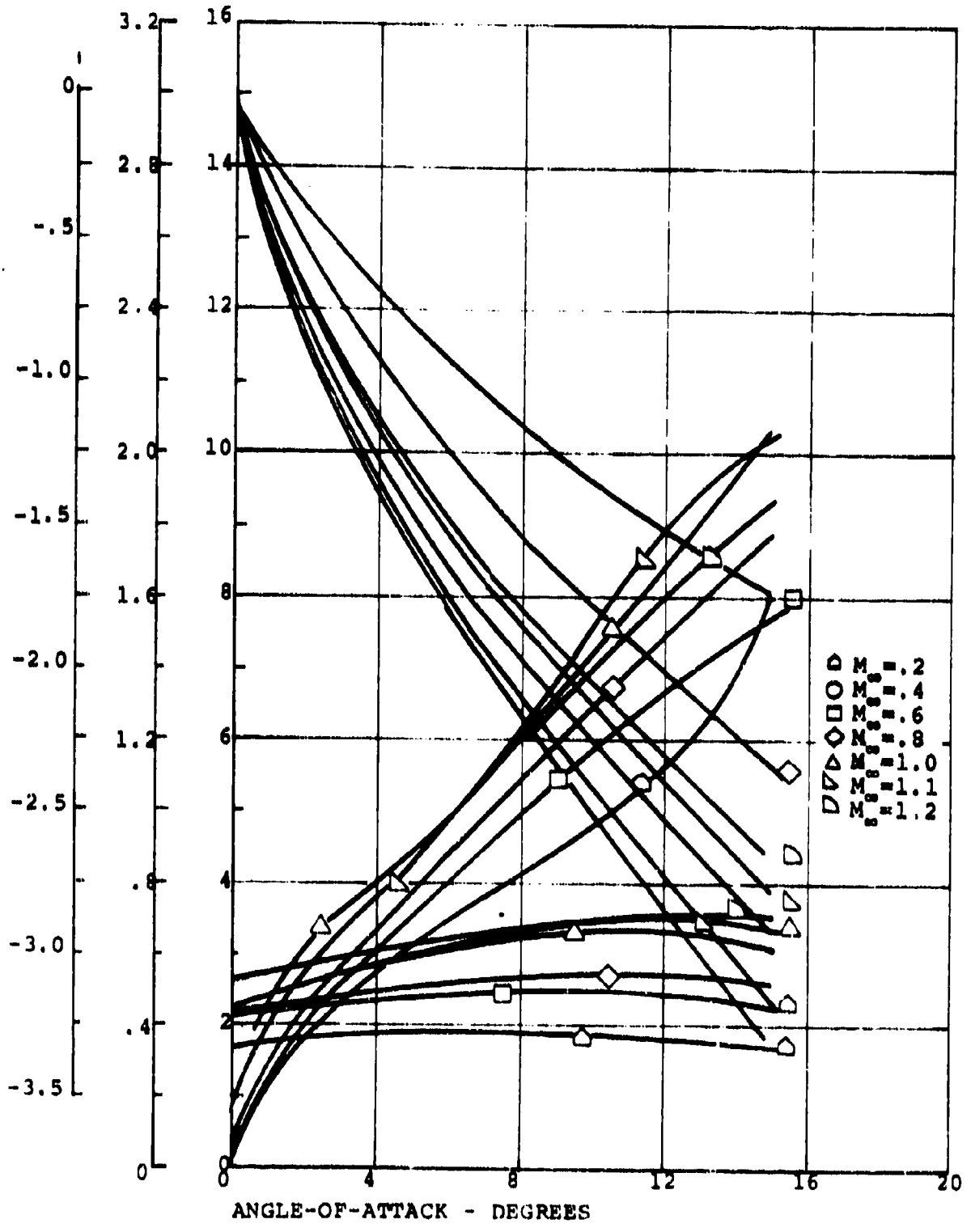
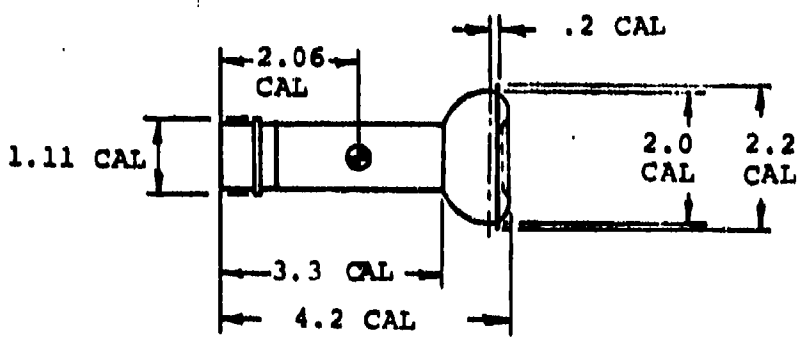


Figure 225. Graphic Static Aerodynamic Test Data: Configuration 105 (Test No. E 10)

Item	Page
Static aerodynamic data	
Tabulated	
Plotted	362
Dynamic stability data	
Tabulated	
Plotted	



General data
- Model weight = not applicable
- Moment of inertia = not applicable

Description of components
- Nose shape = 1.0 caliber ogive
- Tripper = none
- Fineness ratio = 4.0 caliber
- Stabilizer = see sketch
- Burble fence = see sketch
- Boattail = none
- Strakes (8) = none

Remarks

Figure 226. Model Specifications for Configuration 106

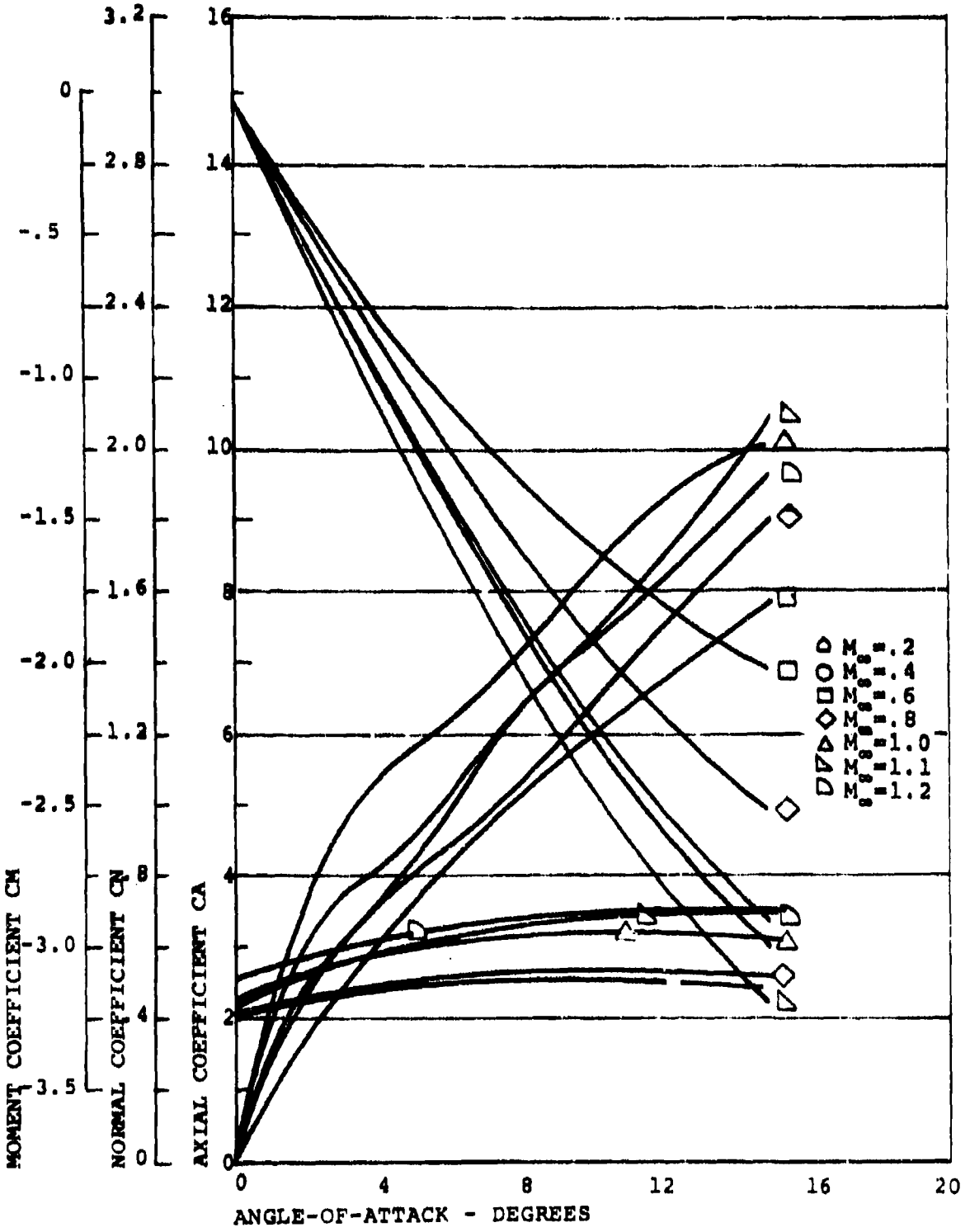
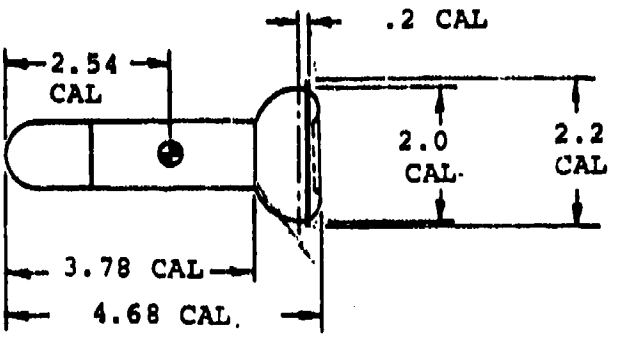


Figure 227. Graphic Static Aerodynamic Test Data: Configuration 106 (Test No. E 11)

Item	Page
Static aerodynamic data	
Tabulated	
Plotted	364
Dynamic stability data	
Tabulated	
Plotted	



General data
- Model weight = not applicable
- Moment of inertia = not applicable

Description of components
- Nose shape = 1.0 caliber ogive
- Tripper = none
- Fineness ratio = 4.0 caliber
- Stabilizer = see sketch
- Burble fence = see sketch
- Boattail = none
- Strakes (8) = none

Remarks

Figure 228. Model Specifications for Configuration 107

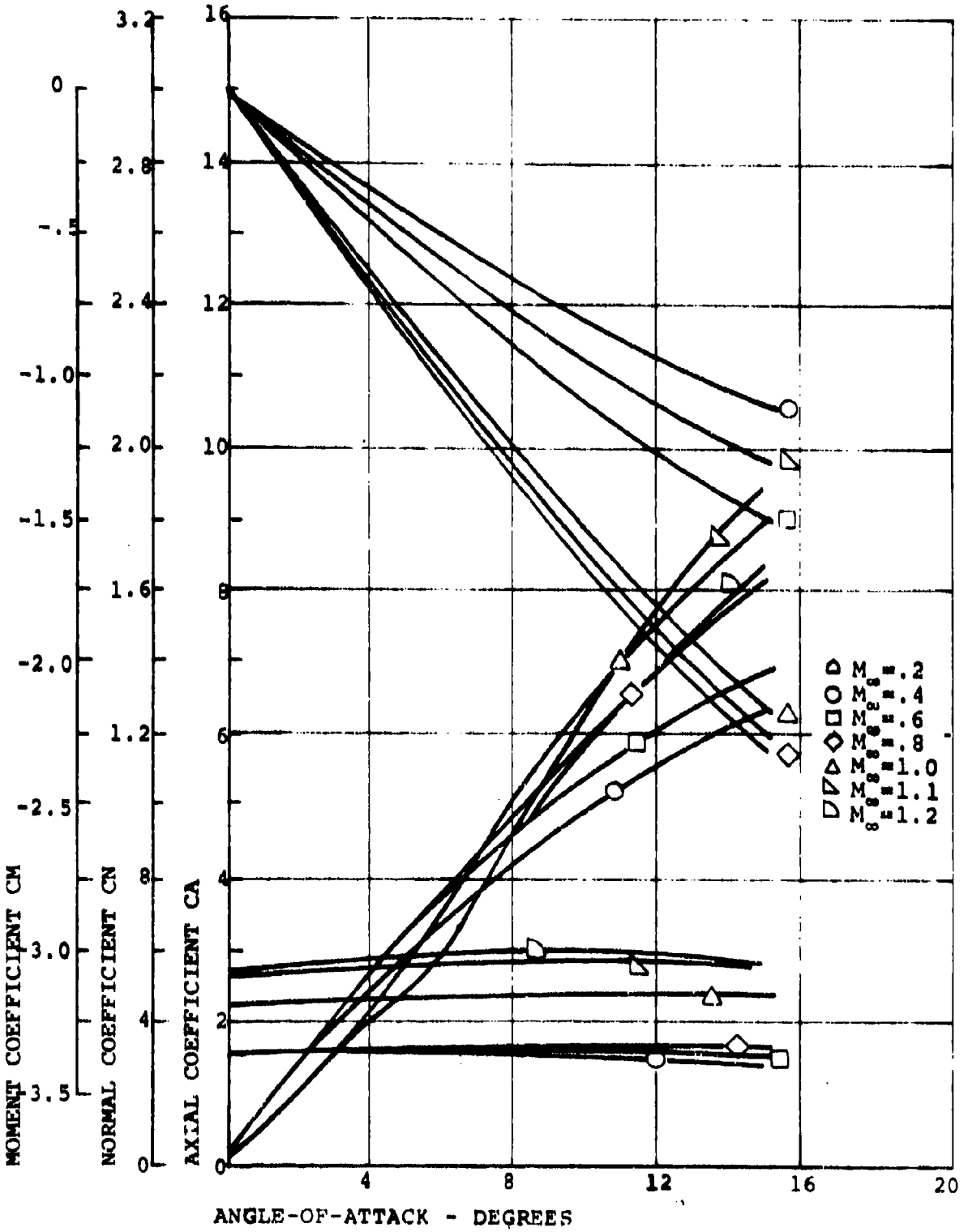
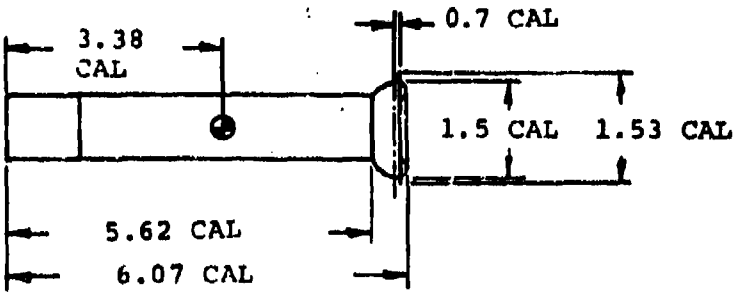


Figure 229. Graphic Static Aerodynamics Test Data: Configuration 107 (Test No. E 12)

Item	Page
Static aerodynamic data	
Tabulated	
Plotted	366
Dynamic stability data	
Tabulated	
Plotted	



General data
- Model weight = not applicable
- Moment of inertia = not applicable

Description of components
- Nose shape = 1.0 caliber ogive
- Tripper = none
- Fineness ratio = 4.0 caliber
- Stabilizer = see sketch
- Burble fence = see sketch
- Boattail = none
- Strakes (8) = none

Remarks

Figure 230. Model Specifications for Configuration 108

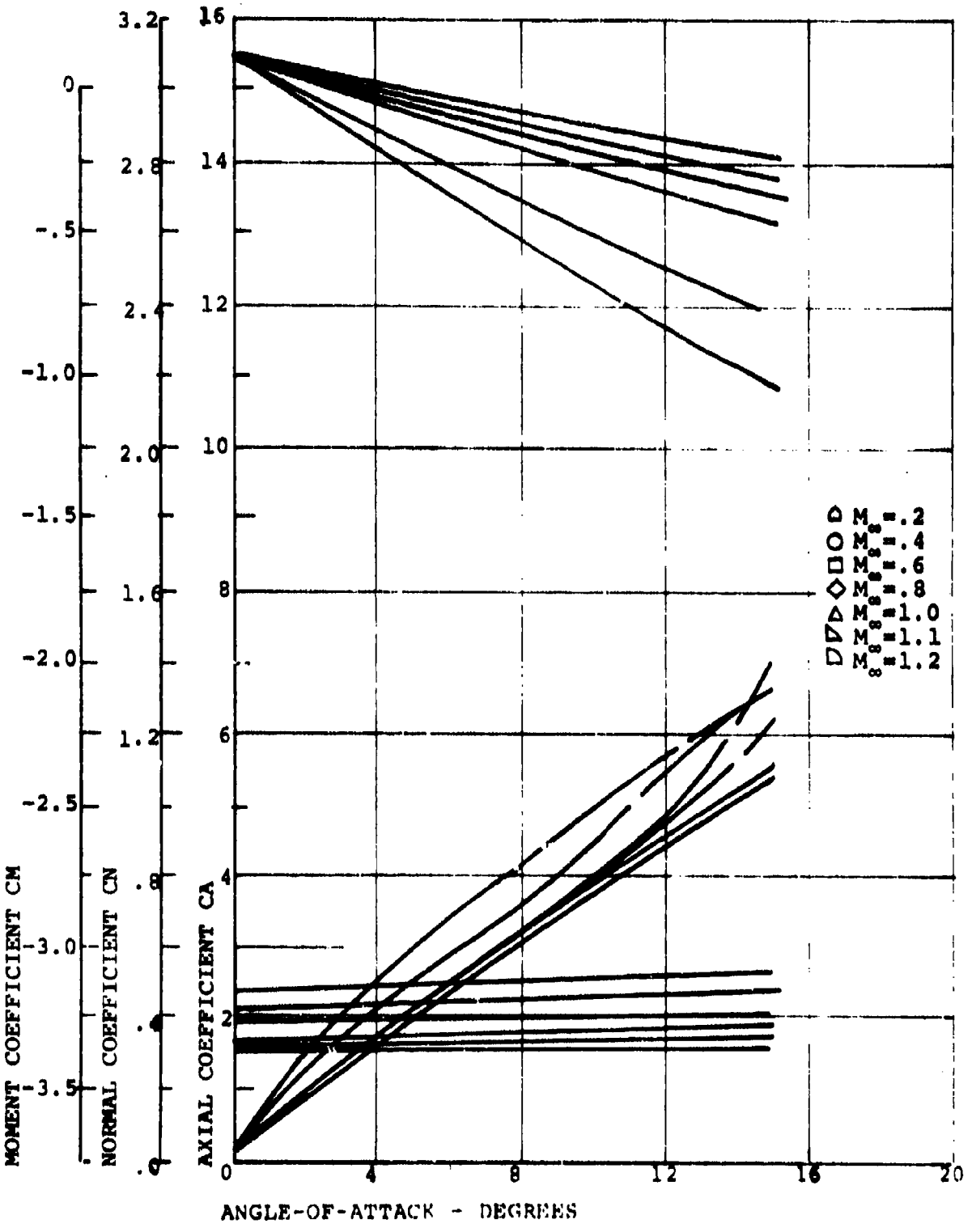
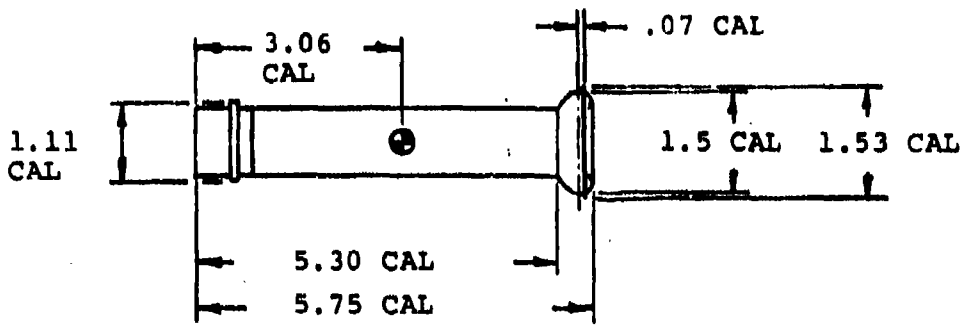


Figure 231. Graphic Static Aerodynamic Test Data: Configuration 108 (Test No. E 13)

Item	Page
Static aerodynamic data	
Tabulated	
Plotted	368
Dynamic stability data	
Tabulated	
Plotted	



General data
- Model weight = not applicable
- Moment of inertia = not applicable

Description of components
- Nose shape = 1.0 caliber ogive
- Tripper = none
- Fineness ratio = 4.0 caliber
- Stabilizer = see sketch
- Burble fence = see sketch
- Boattail = none
- Strakes (8) = none

Remarks

Figure 232. Model Specifications for Configuration 109

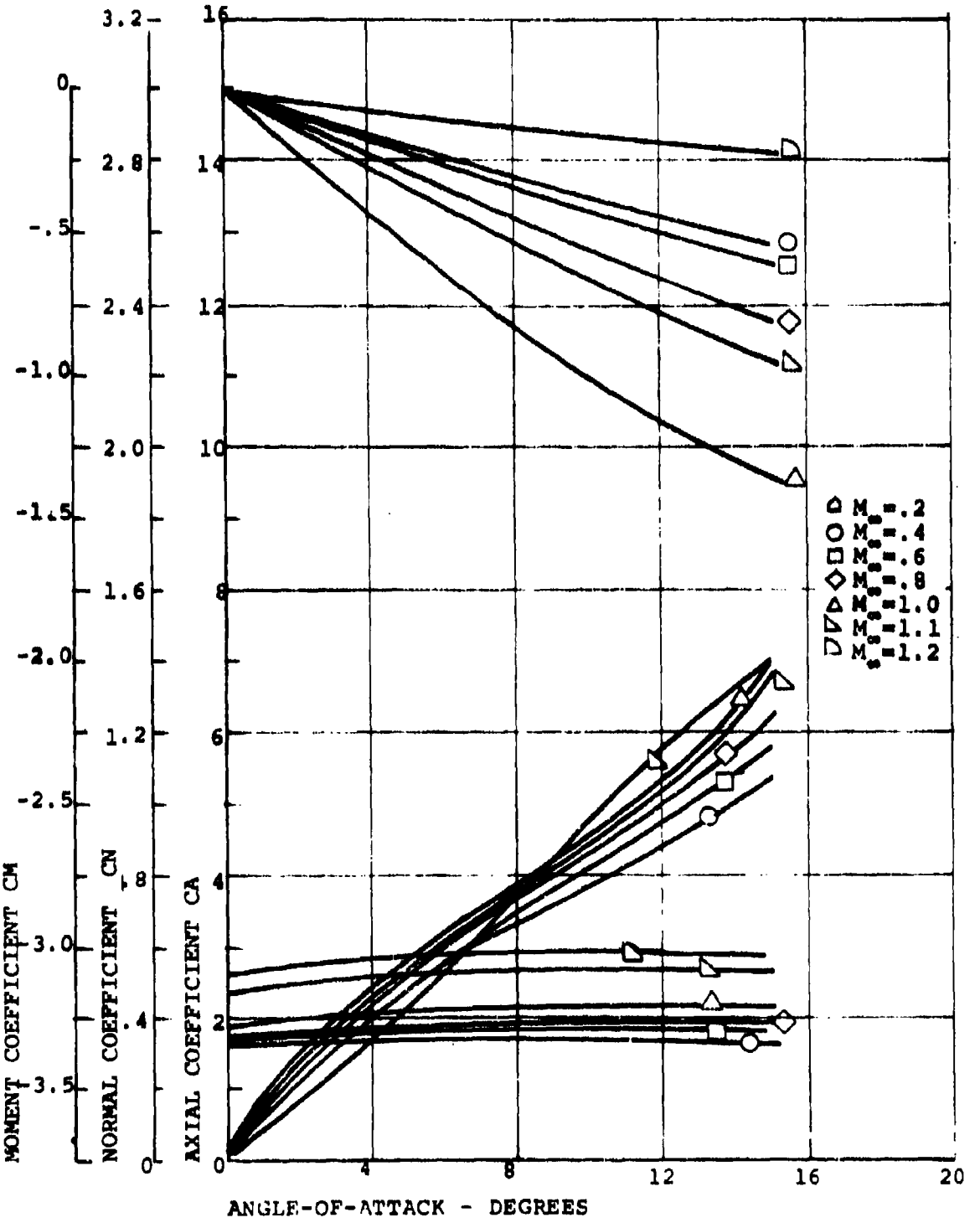
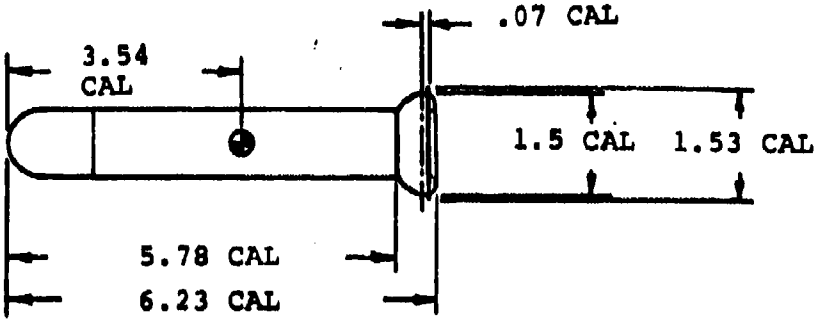


Figure 233. Graphic Static Aerodynamic Test Data: Configuration 109 (Test No. E 14)

Item	Page
Static aerodynamic data	
Tabulated	
Plotted	370
Dynamic stability data	
Tabulated	
Plotted	



General data
- Model weight = not applicable
- Moment of inertia = not applicable

Description of components
- Nose shape = 1.0 caliber ogive
- Tripper = none
- Fineness ratio = 4.0 caliber
- Stabilizer = see sketch
- Burble fence = see sketch
- Boattail = none
- Strakes (8) = none

Remarks

Figure 234. Model Specifications for Configuration 110

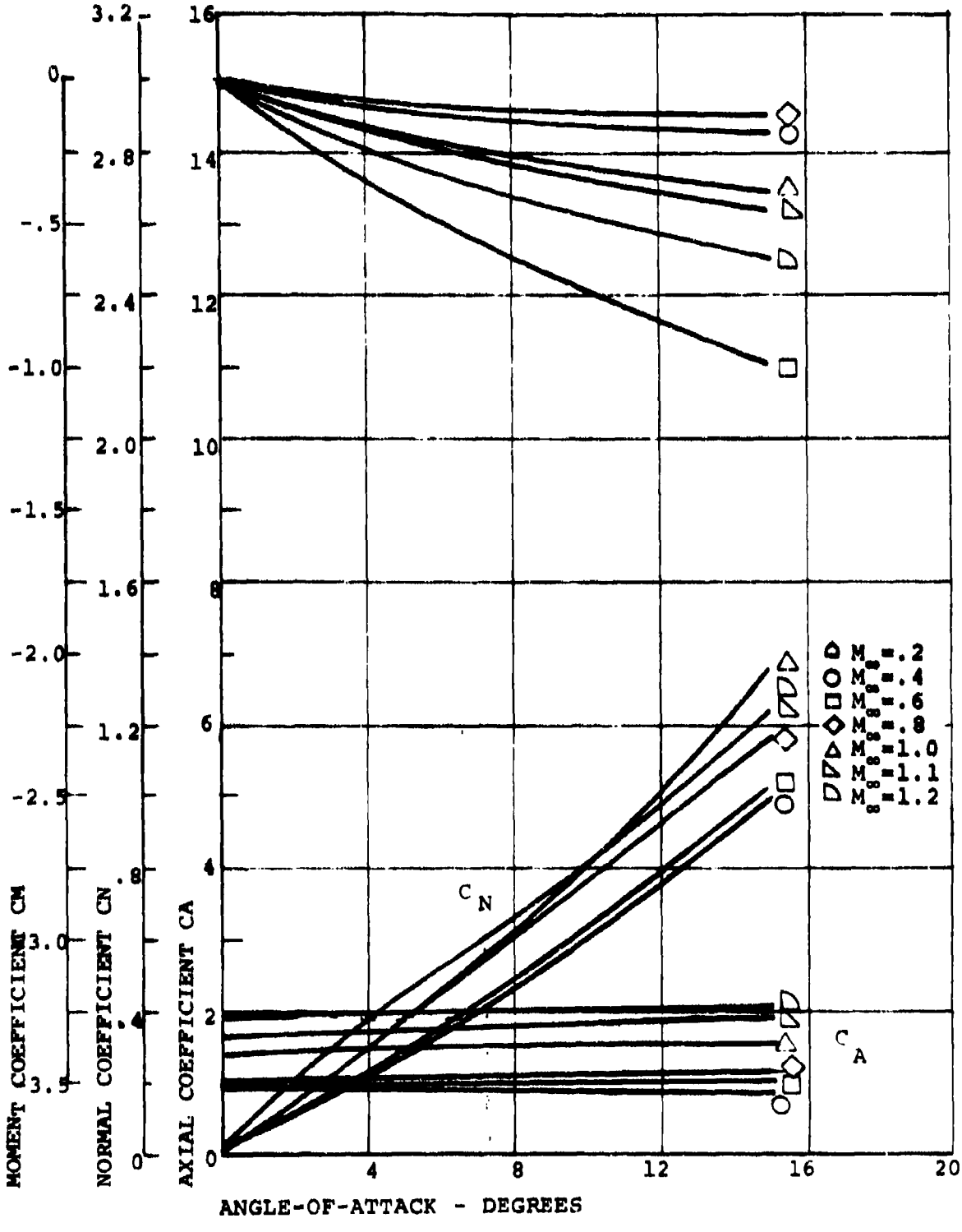
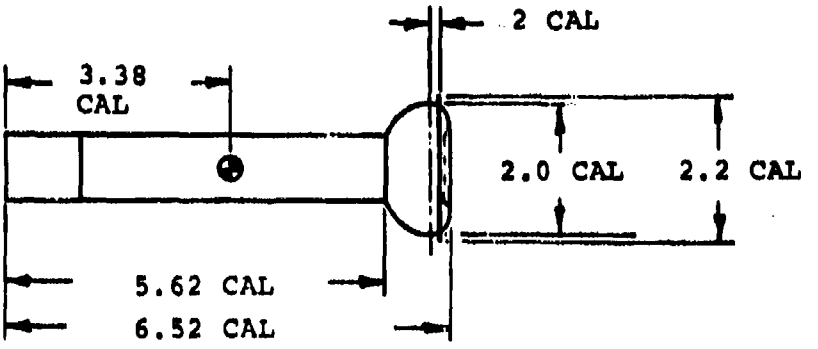


Figure 235. Graphic Static Aerodynamic Test Data: Configuration 110 (Test No. E 15)

Item	Page
Static aerodynamic data	
Tabulated	
Plotted	372
Dynamic stability data	
Tabulated	
Plotted	



General data
- Model weight = not applicable
- Moment of inertia = not applicable

Description of components
- Nose shape = 1.0 caliber ogive
- Tripper = none
- Fineness ratio = 4.0 caliber
- Stabilizer = see sketch
- Burble fence = see sketch
- Boattail = none
- Strakes (8) = none

Remarks

Figure 236. Model Specifications for Configuration 111

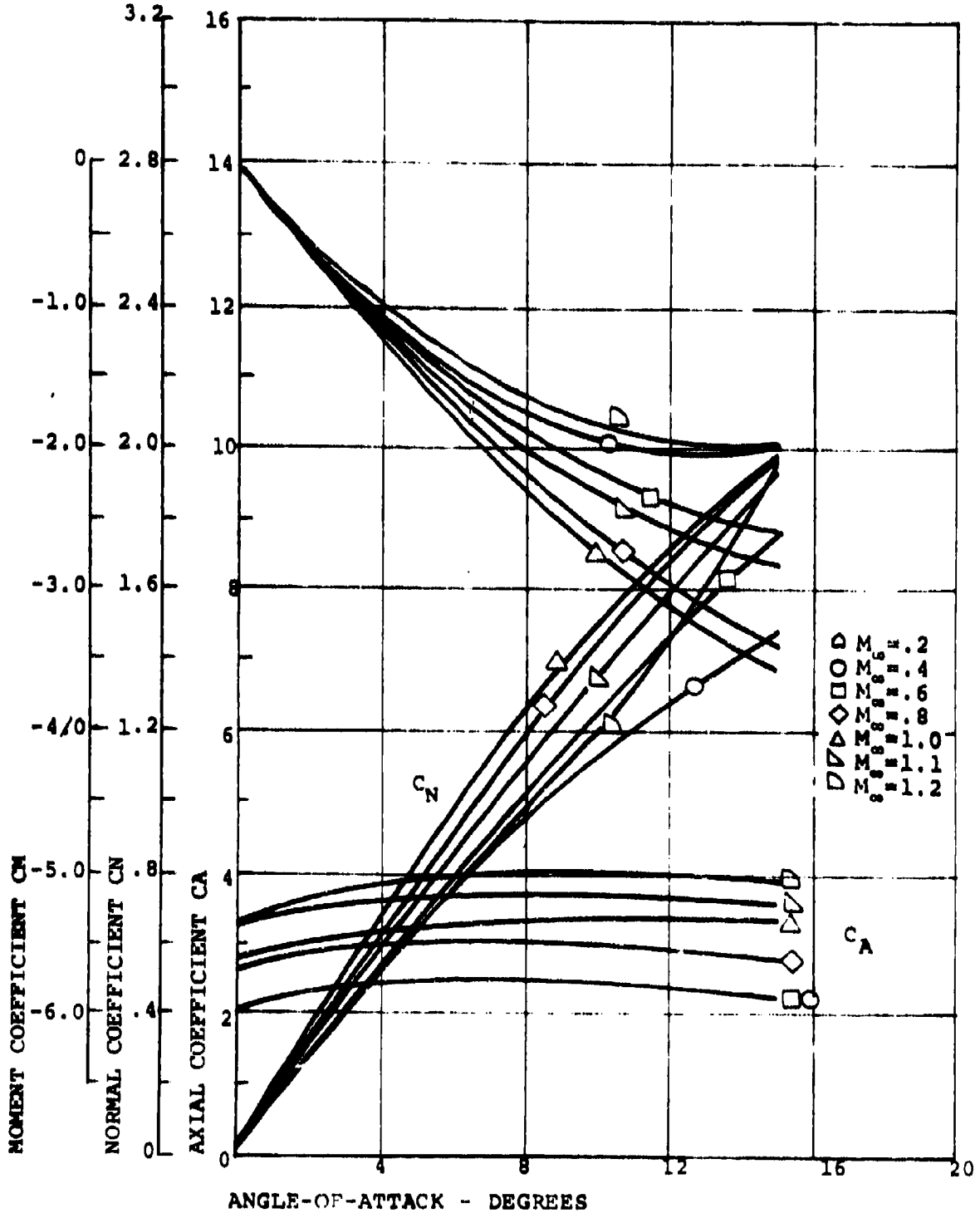
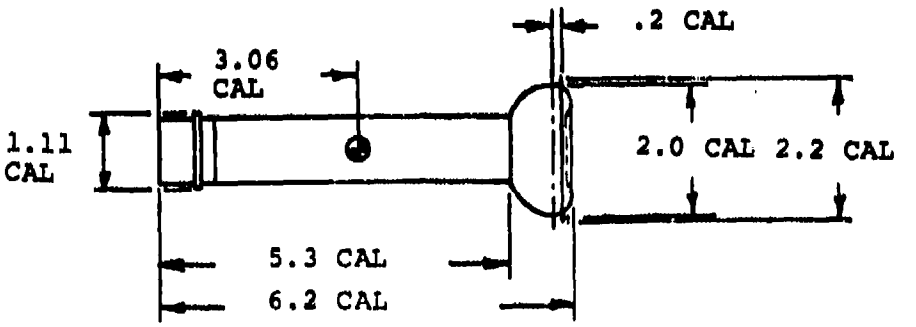


Figure 237. Graphic Static Aerodynamic Test Data: Configuration 111 (Test No E 16)

Item	Page
Static aerodynamic data	
Tabulated	
Plotted	374
Dynamic stability data	
Tabulated	
Plotted	



General data
- Model weight = not applicable
- Moment of inertia = not applicable

Description of components
- Nose shape = 1.0 caliber ogive
- Tripper = none
- Fineness ratio = 4.0 caliber
- Stabilizer = see sketch
- Burble fence = see sketch
- Boattail = none
- Strakes (8) = none

Remarks

Figure 238. Model Specifications for Configuration 112

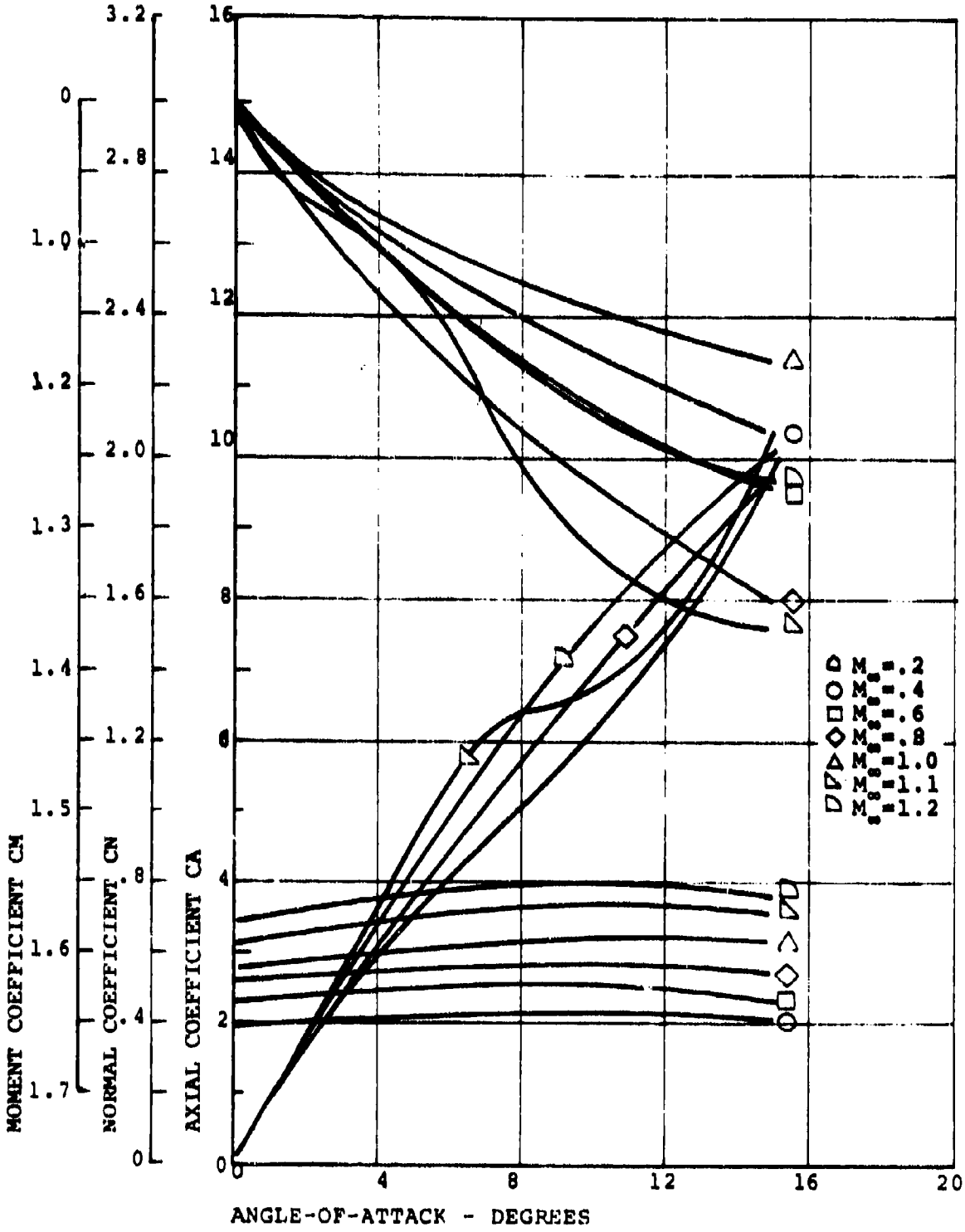
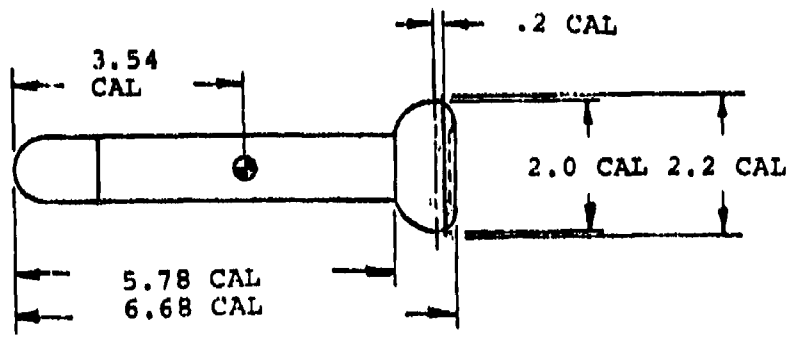


Figure 239. Graphic Static Aerodynamic Test Data: Configuration 112 (Test No. E 17)

Item	Page
Static aerodynamic data	
Tabulated	
Plotted	376
Dynamic stability data	
Tabulated	
Plotted	



General data

Model weight	=	not applicable
Moment of inertia	=	not applicable

Description of components

Nose shape	=	1.0 caliber ogive
Tripper	=	none
Fineness ratio	=	4.0 caliber
Stabilizer	=	see sketch
Burble fence	=	see sketch
Boattail	=	none
Strakes (8)	=	none

Remarks

Figure 240. Model Specifications for Configuration 113

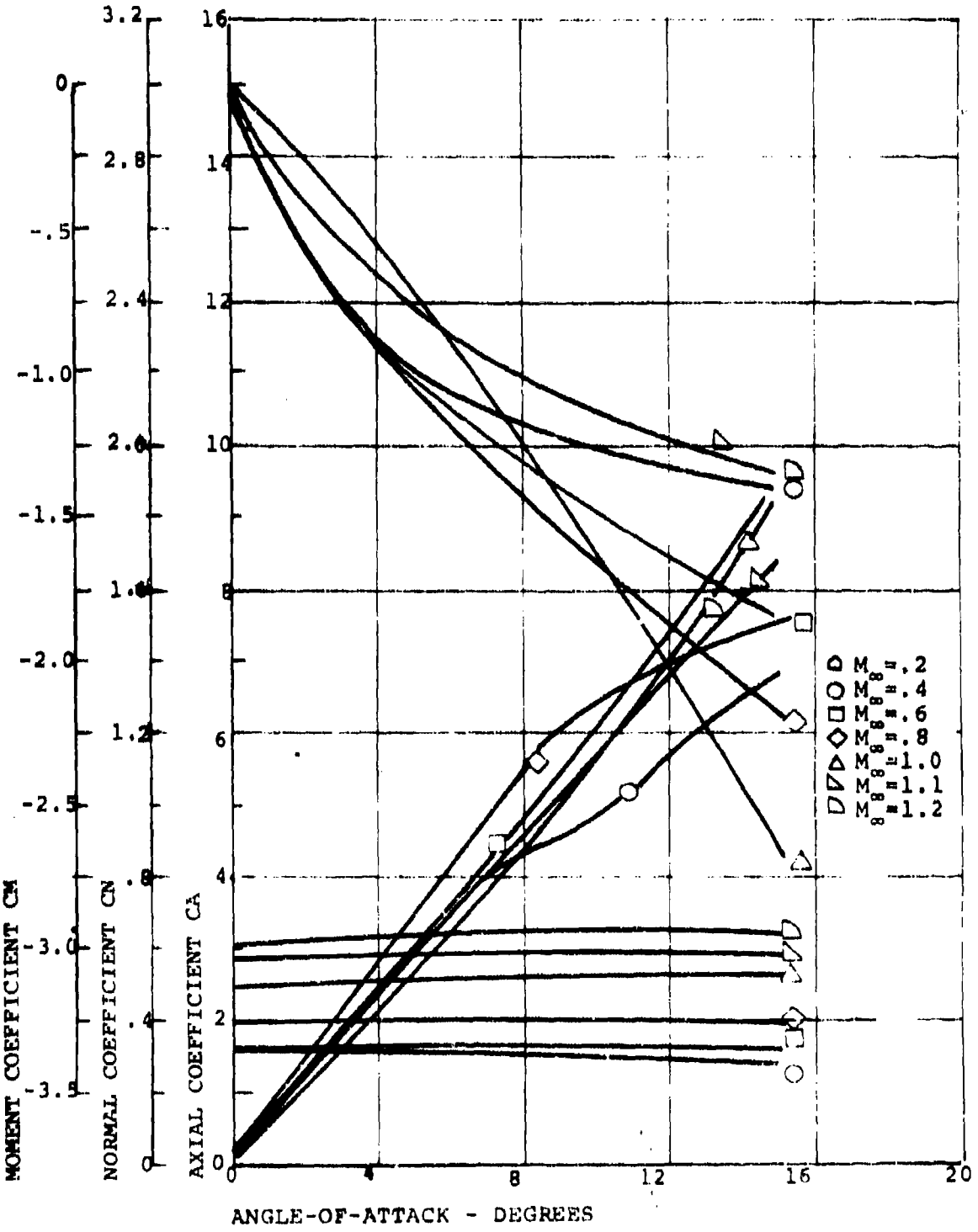
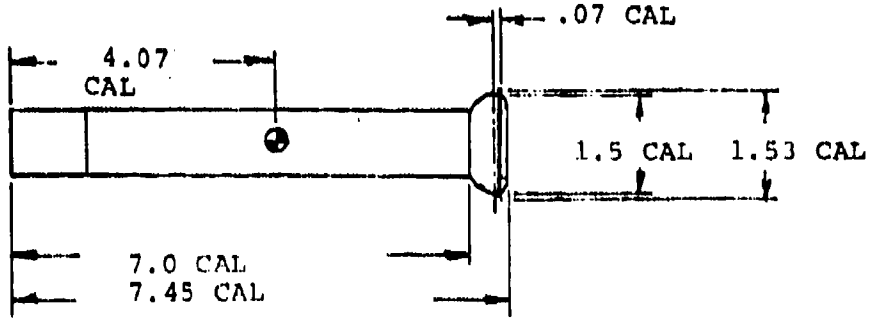


Figure 241. Graphic Static Aerodynamic Test Data: Configuration 113 (Test No. E 18)

Item	Page
Static aerodynamic data	
Tabulated	
Plotted	378
Dynamic stability data	
Tabulated	
Plotted	



General data

Model weight = not applicable
Moment of inertia = not applicable

Description of components

Nose shape = 1.0 caliber ogive
Tripper = none
Fineness ratio = 4.0 caliber
Stabilizer = see sketch
Burble fence = see sketch
Boattail = none
Strakes (8) = none

Remarks

Figure 242. Model Specifications for Configuration 114

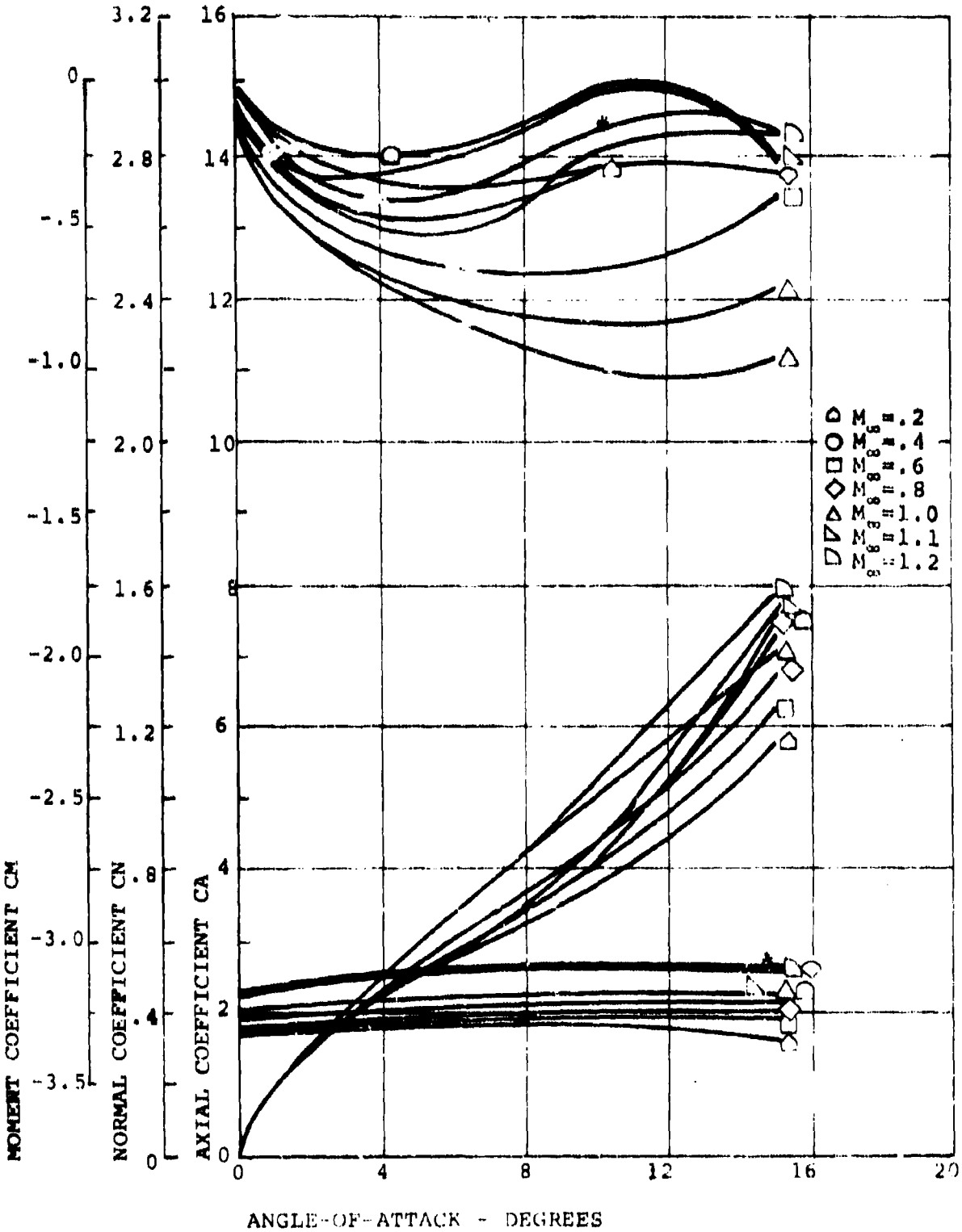
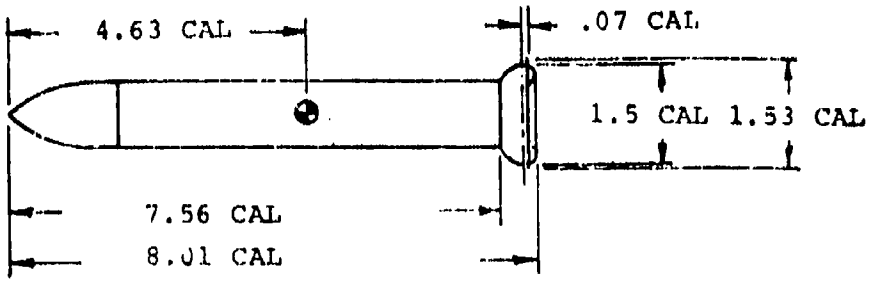


Figure 243. Graphic Static Aerodynamic Test Data: Configuration 114 (Test No. E 19)

Item	Page
Static aerodynamic data	
Tabulated	
Plotted	380
Dynamic stability data	
Tabulated	
Plotted	



General data
- Model weight = not applicable
- Moment of inertia = not applicable

Description of components
- Nose shape = 1.0 caliber ogive
- Tripper = none
- Fineness ratio = 4.0 caliber
- Stabilizer = see sketch
- Burble fence = see sketch
- Boattail = none
- Strakes (8) = none

Remarks

Figure 244. Model Specification for Configuration 115

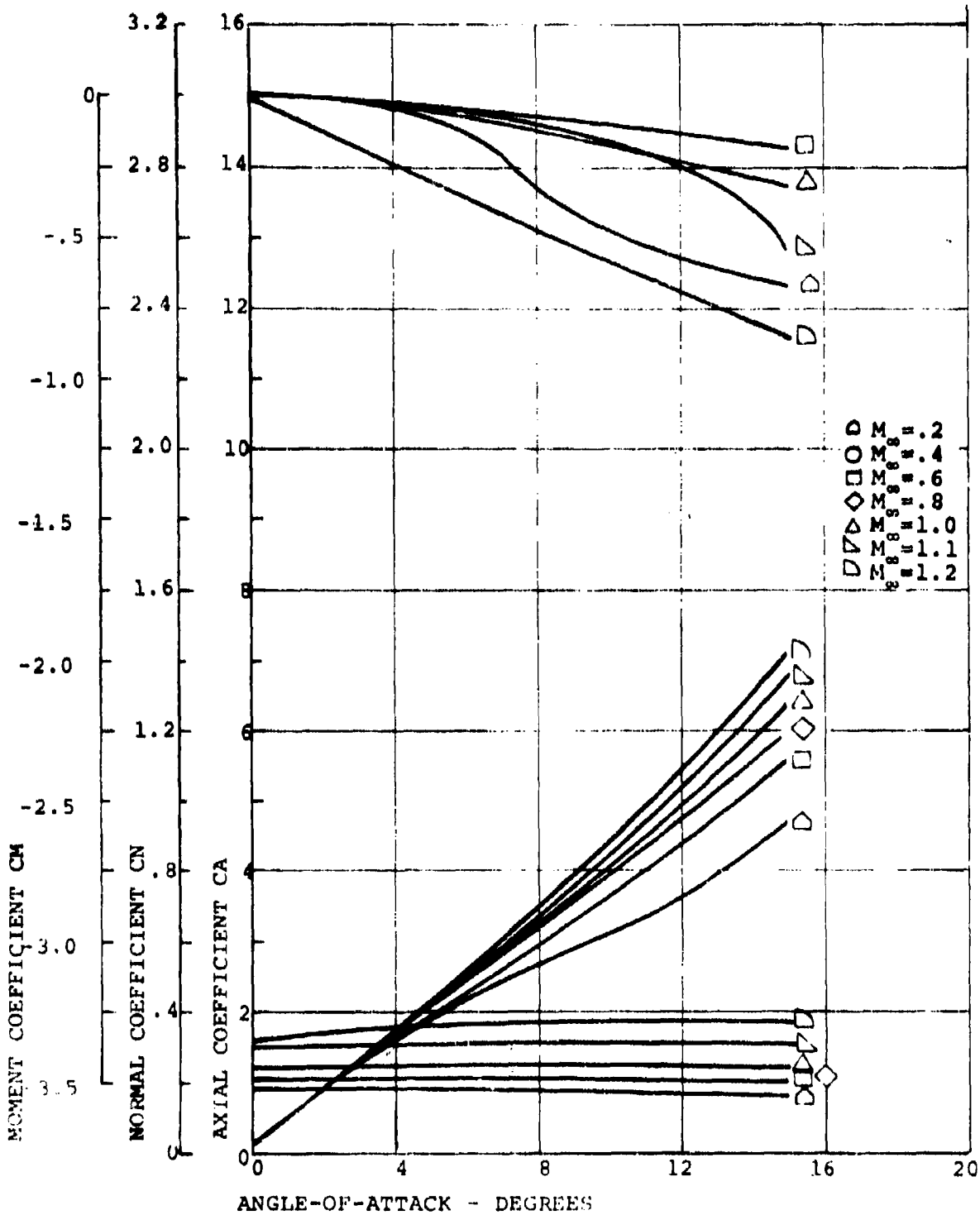
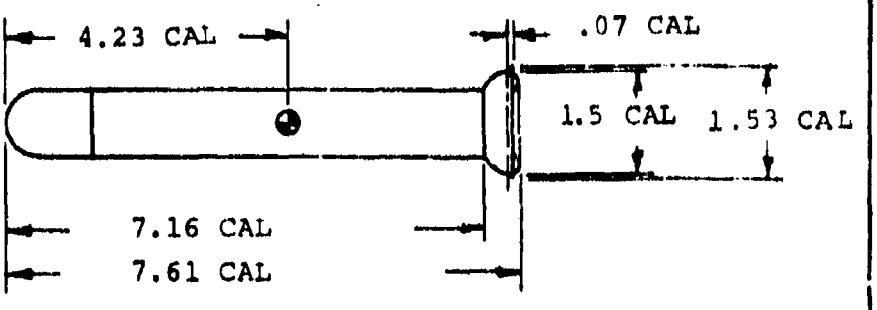


Figure 245. Graphic Static Aerodynamic Test Data: Configuration 115 (Test No. E 20)

Item	Page
Static aerodynamic data	
Tabulated	
Plotted	382
Dynamic stability data	
Tabulated	
Plotted	



General data
- Model weight = not applicable
- Moment of inertia = not applicable

Description of components
- Nose shape = 1.0 caliber ogive
- Tripper = none
- Fineness ratio = 4.0 caliber
- Stabilizer = see sketch
- Burble fence = see sketch
- Boattail = none
- Strakes (8) = none

Remarks

Figure 246. Model Specification for Configuration 116

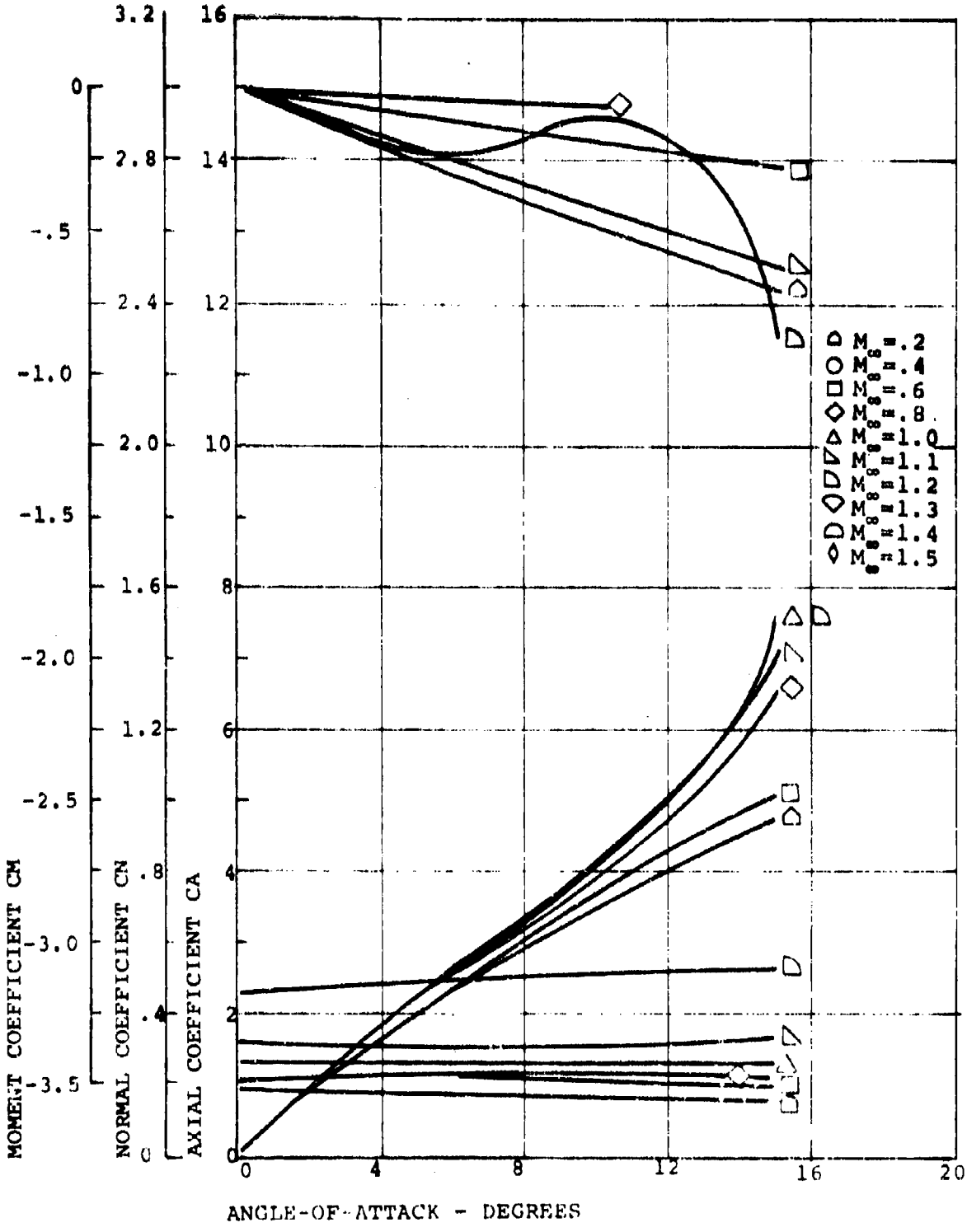
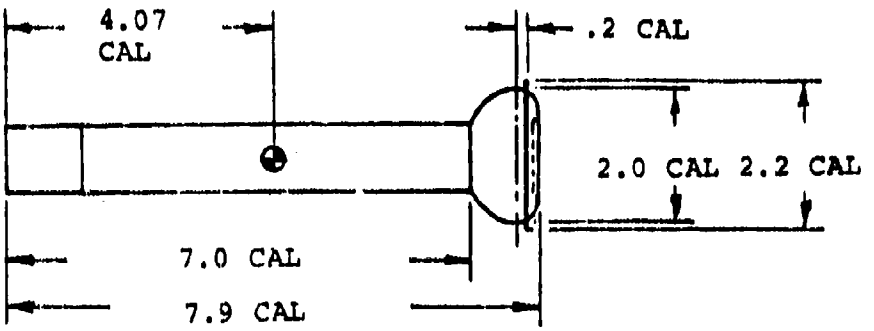


Figure 247. Graphic Static Aerodynamic Test Data: Configuration 116 (Test No. E 21)

Item	Page
Static aerodynamic data	
Tabulated	
Plotted	384
Dynamic stability data	
Tabulated	
Plotted	



General data
- Model weight = not applicable
- Moment of inertia = not applicable

Description of components
- Nose shape = 1.0 caliber ogive
- Tripper = none
- Fineness ratio = 4.0 caliber
- Stabilizer = see sketch
- Burble fence = see sketch
- Boattail = none
- Strakes (8) = none

Remarks

Figure 248. Model Specification for Configuration 117

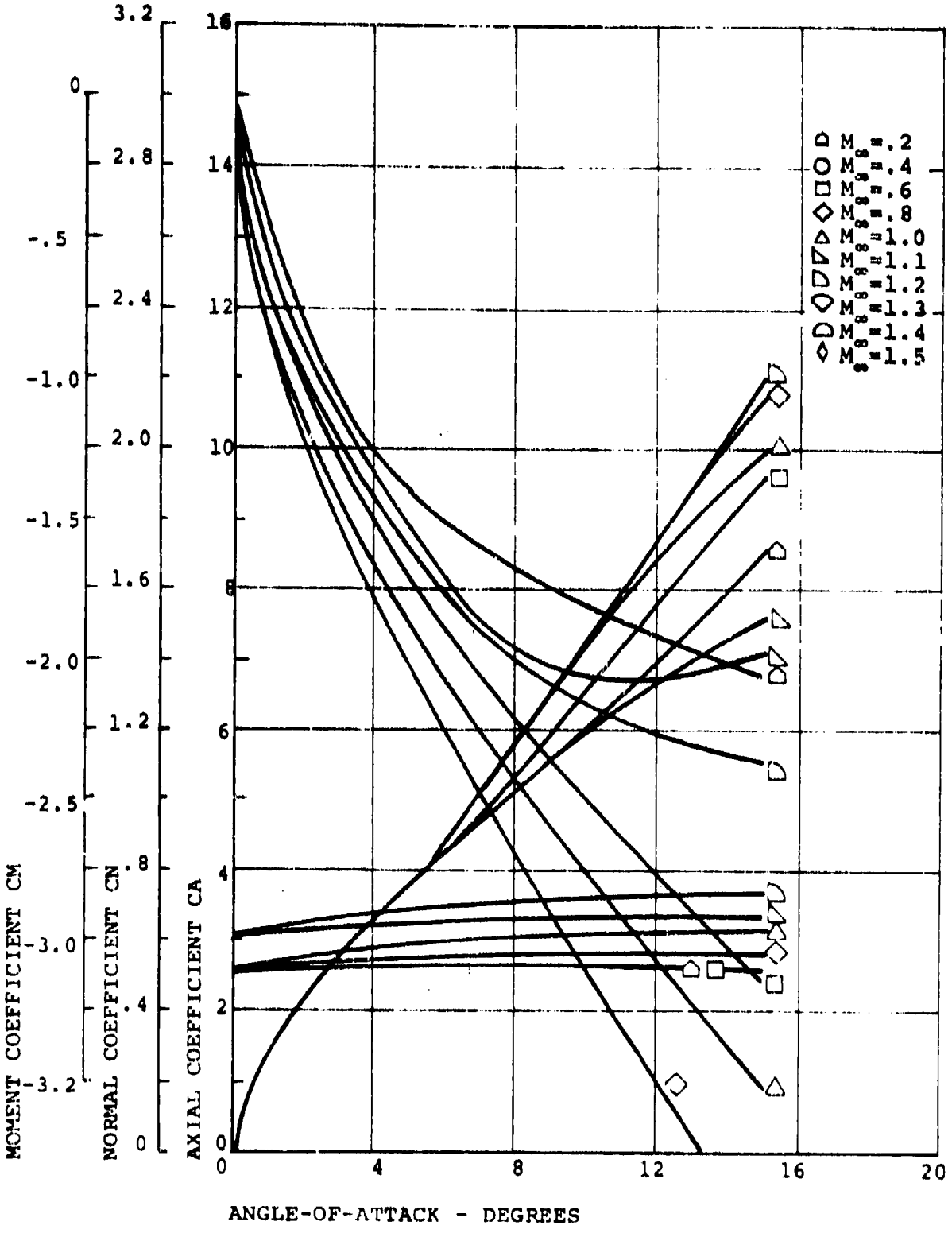
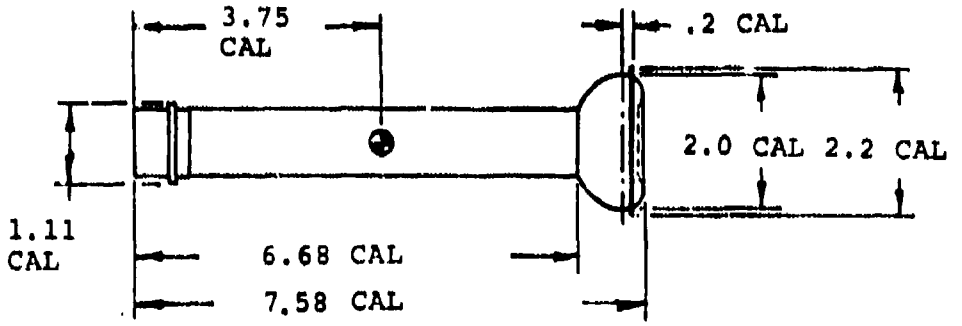


Figure 249. Graphic Static Aerodynamic Test Data: Configuration 117 (Test No. E 22)

Item	Page
Static aerodynamic data	
Tabulated	
Plotted	386
Dynamic stability data	
Tabulated	
Plotted	



General data

Model weight	=	not applicable
Moment of inertia	=	not applicable

Description of components

Nose shape	=	1.0 caliber ogive
Tripper	=	none
Fineness ratio	=	4.0 caliber
Stabilizer	=	see sketch
Burble fence	=	see sketch
Boattail	=	none
Strakes (8)	=	none

Remarks

Figure 250. Model Specifications for Configuration 118

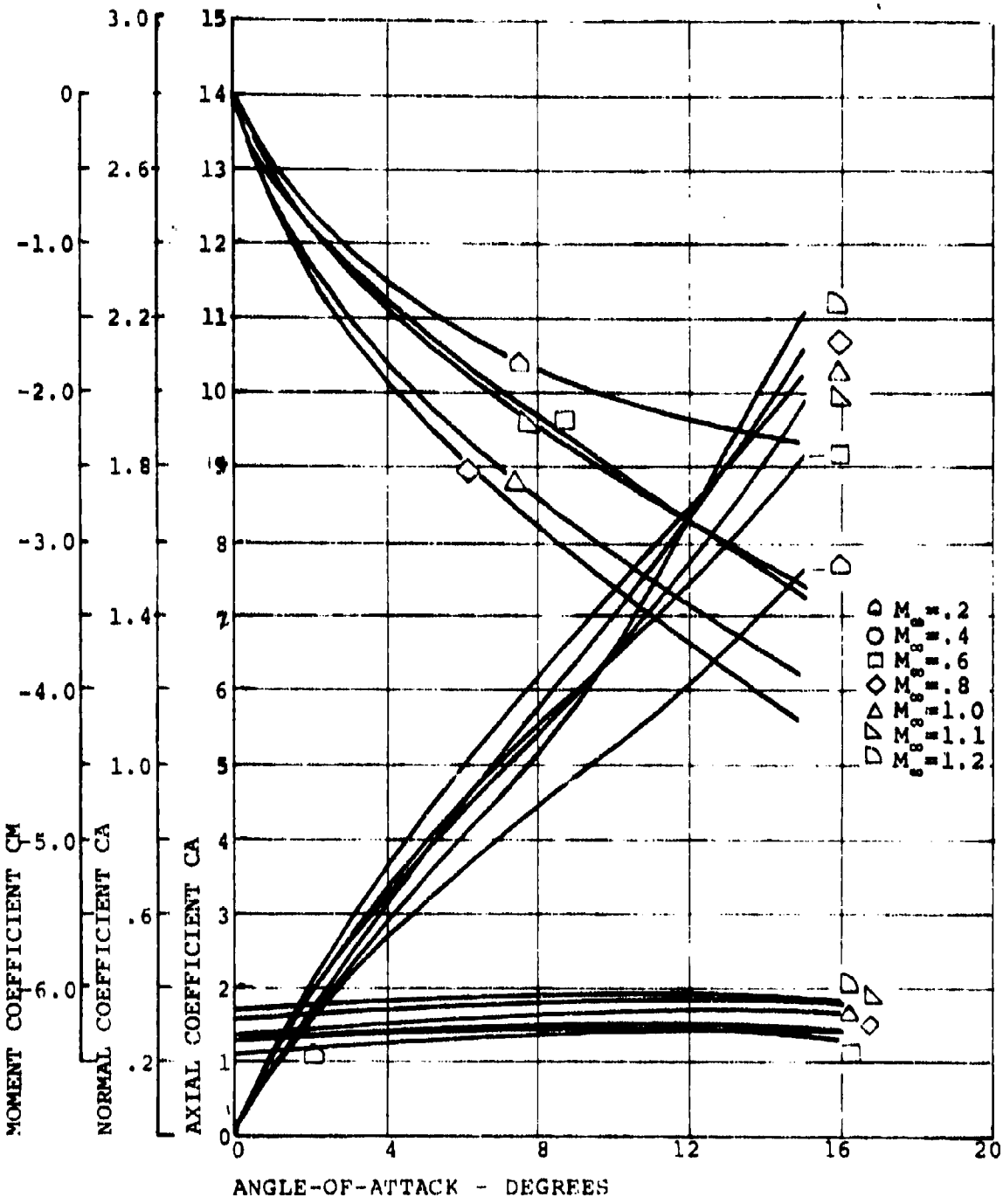
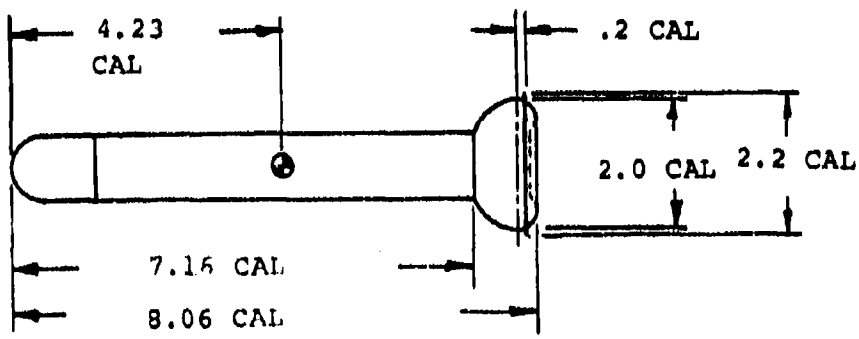


Figure 251. Graphic Static Aerodynamic Test Data: Configuration 118 (Test No. E 23)

Item	Page
Static aerodynamic data	
Tabulated	
Plotted	388
Dynamic stability data	
Tabulated	
Plotted	



General data
- Model weight = not applicable
- Moment of inertia = not applicable

Description of components
- Nose shape = 1.0 caliber ogive
- Tripper = none
- Fineness ratio = 4.0 caliber
- Stabilizer = see sketch
- Burble fence = see sketch
- Boattail = none
- Strakes (8) = none

Remarks

Figure 252. Model Specification for Configuration 119

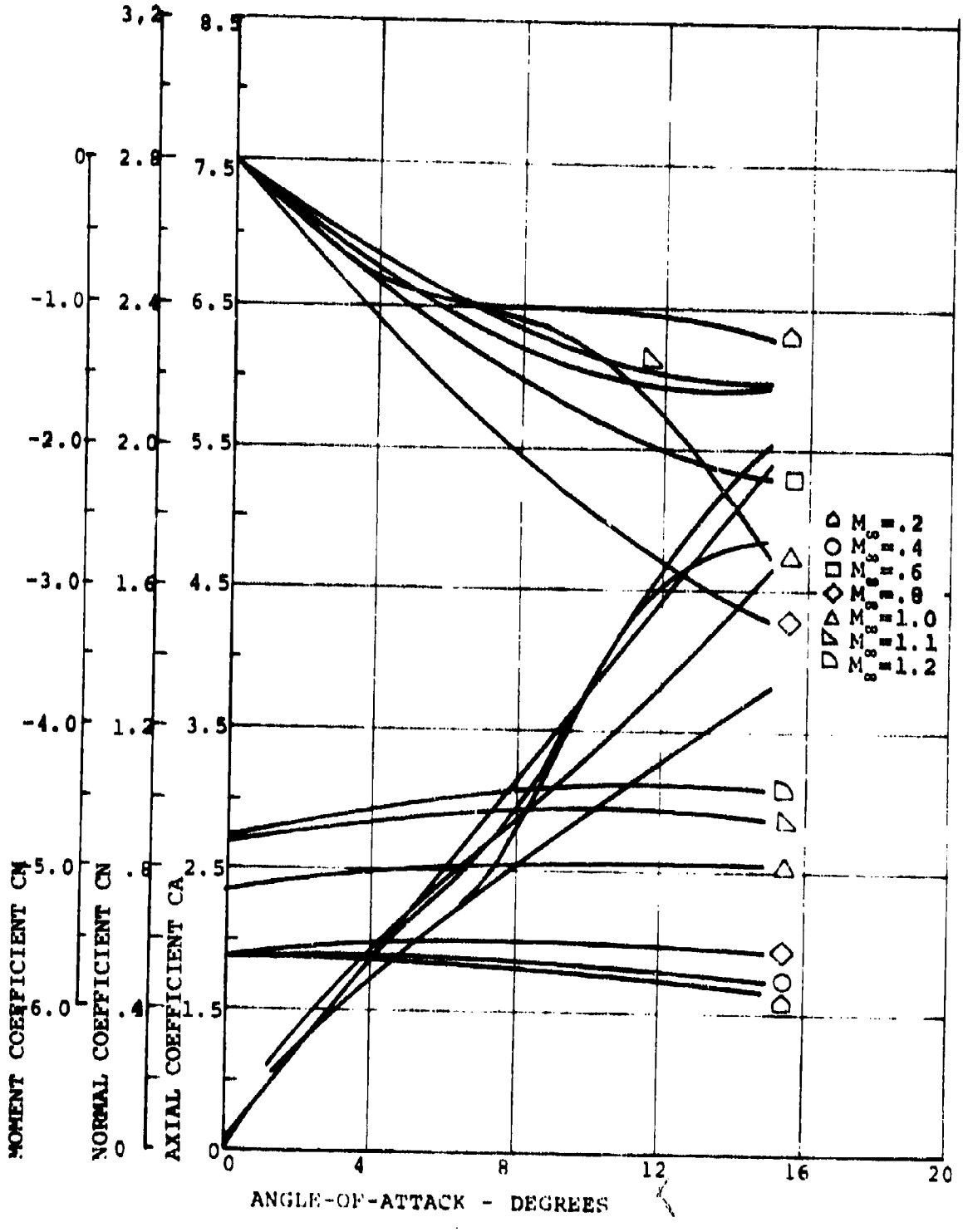


Figure 263. Graphic Static Aerodynamic Test Data: Configuration 119 (Test No. E 24)

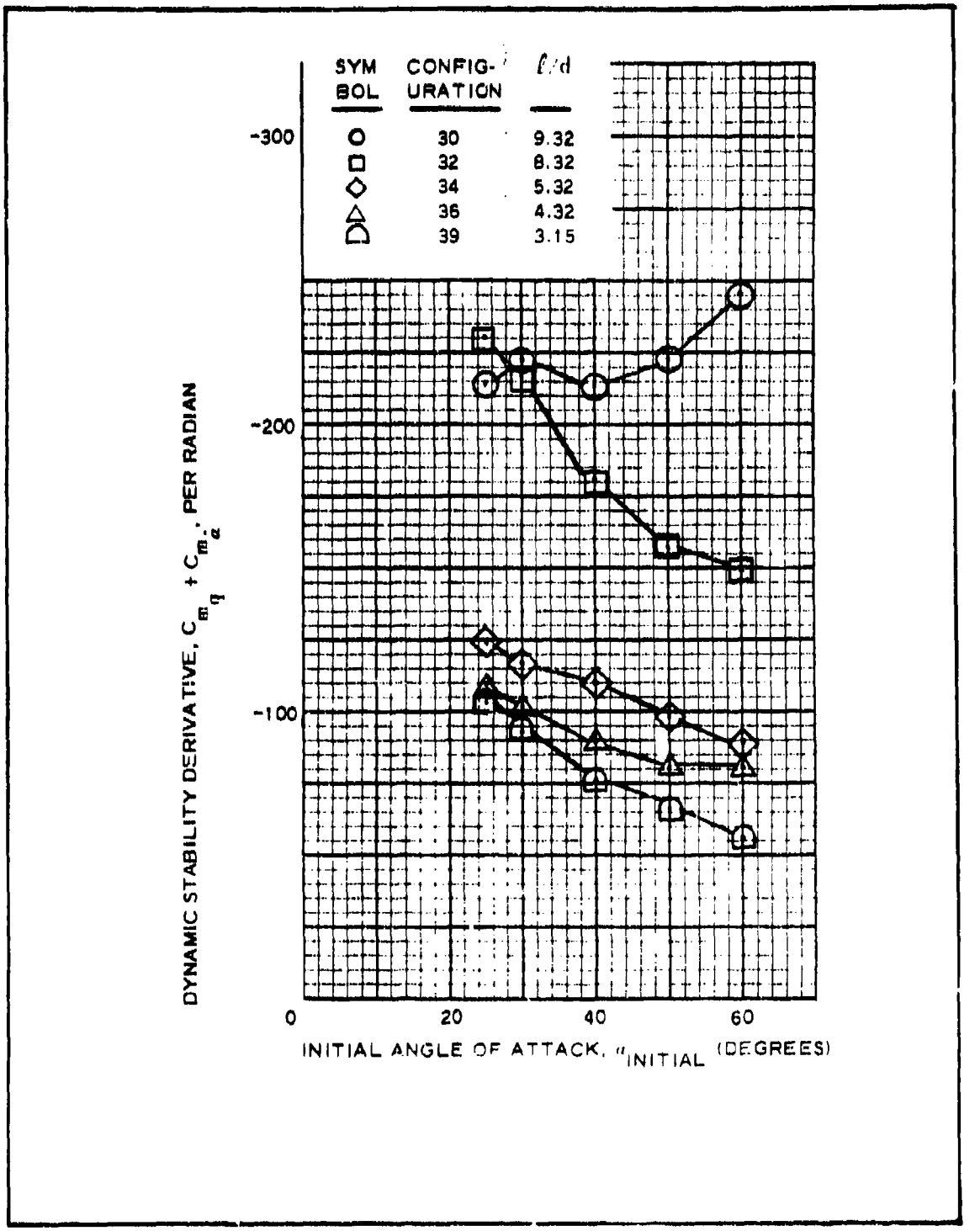


Figure 254. Effect of fineness Ratio on Dynamic Stability of Ballute Stabilized Bomb: 1-1/2-Caliber Ballute, V = 100 Feet per Second

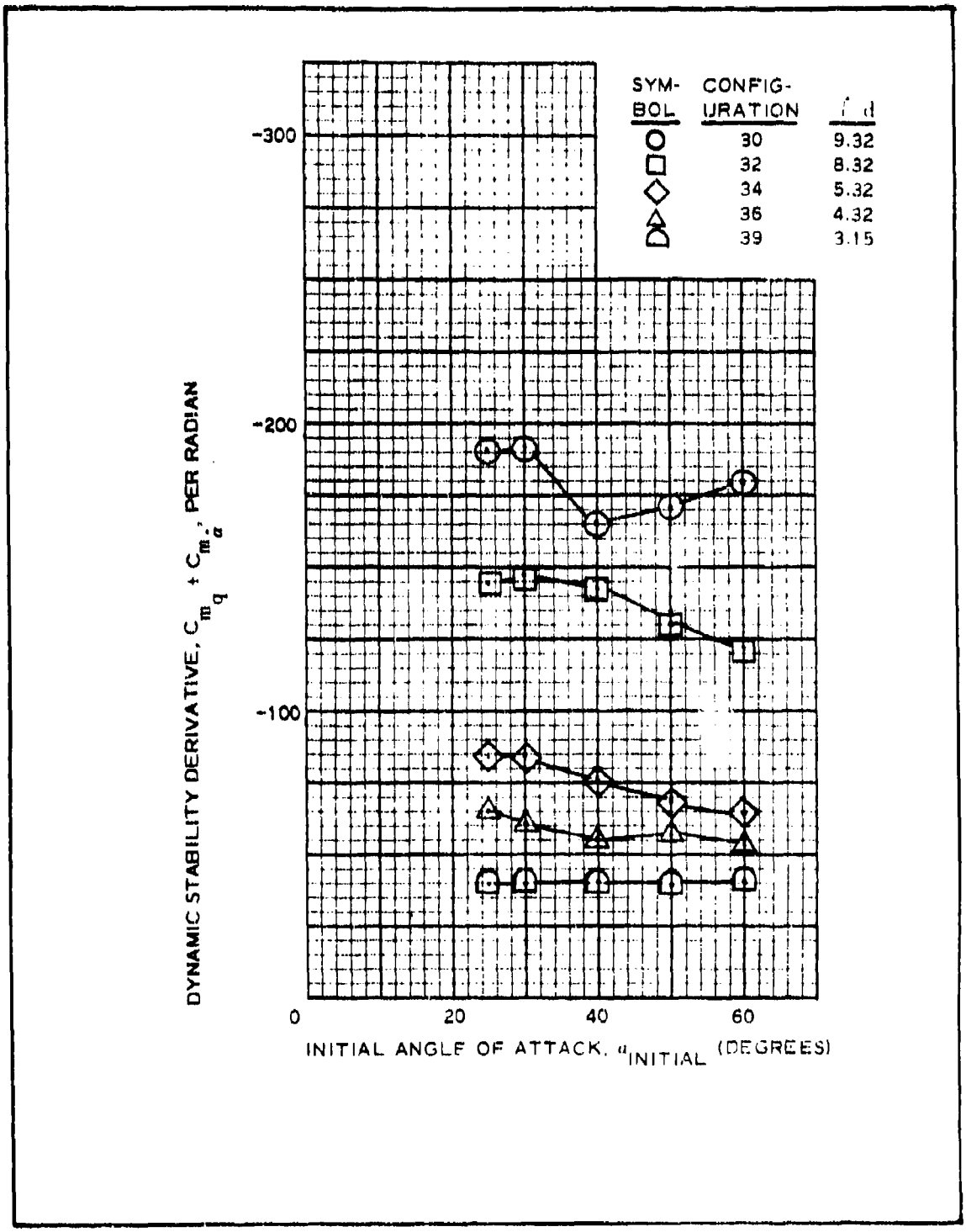


Figure 255. Effect of Fineness Ratio on Dynamic Stability of Ballute Stabilized Bomb: 1-1 2-Caliber Ballute, V = 200 Feet per Second

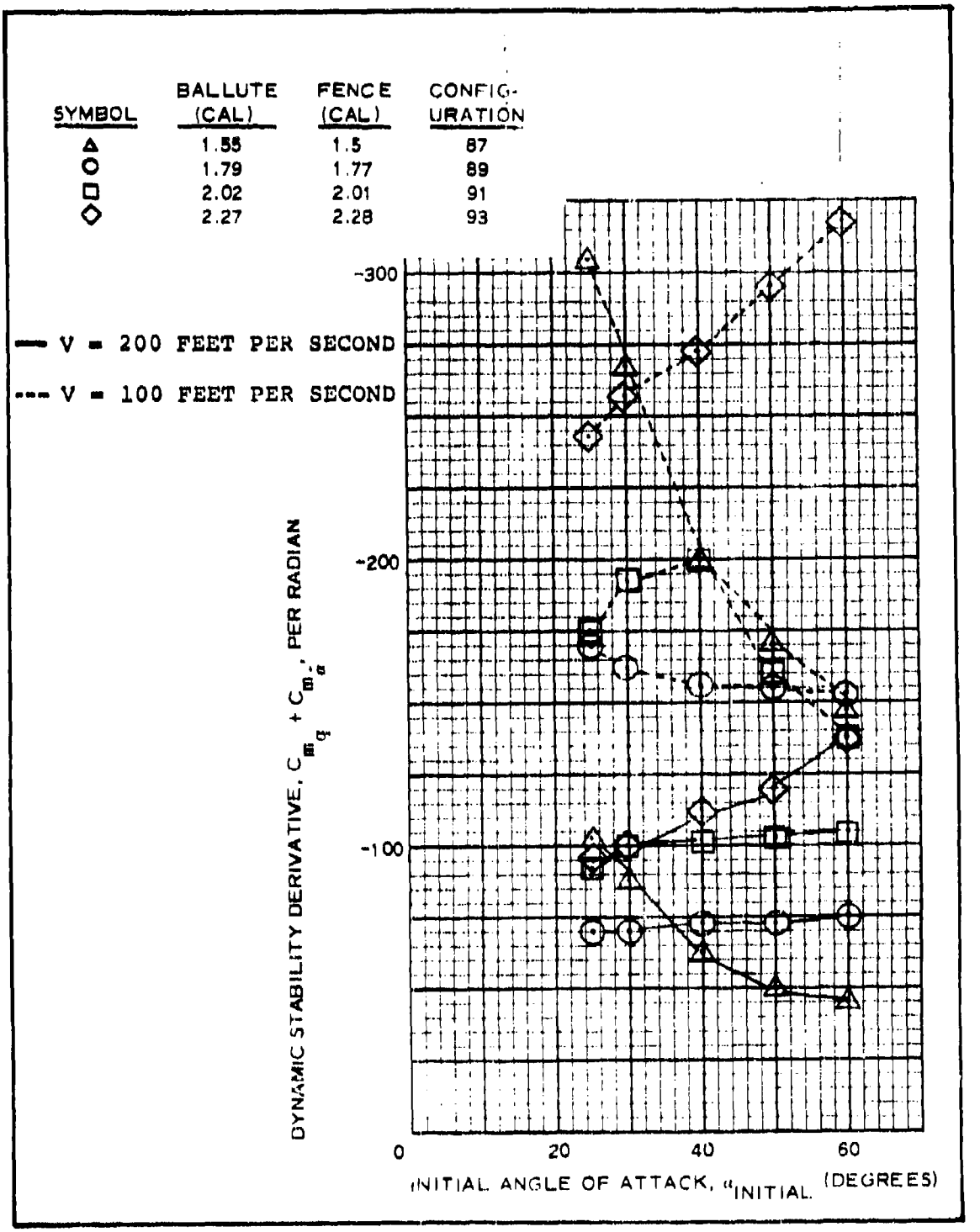


Figure 256. Effect Ballute Size on Dynamic Stability of 3.0-Caliber Bomb

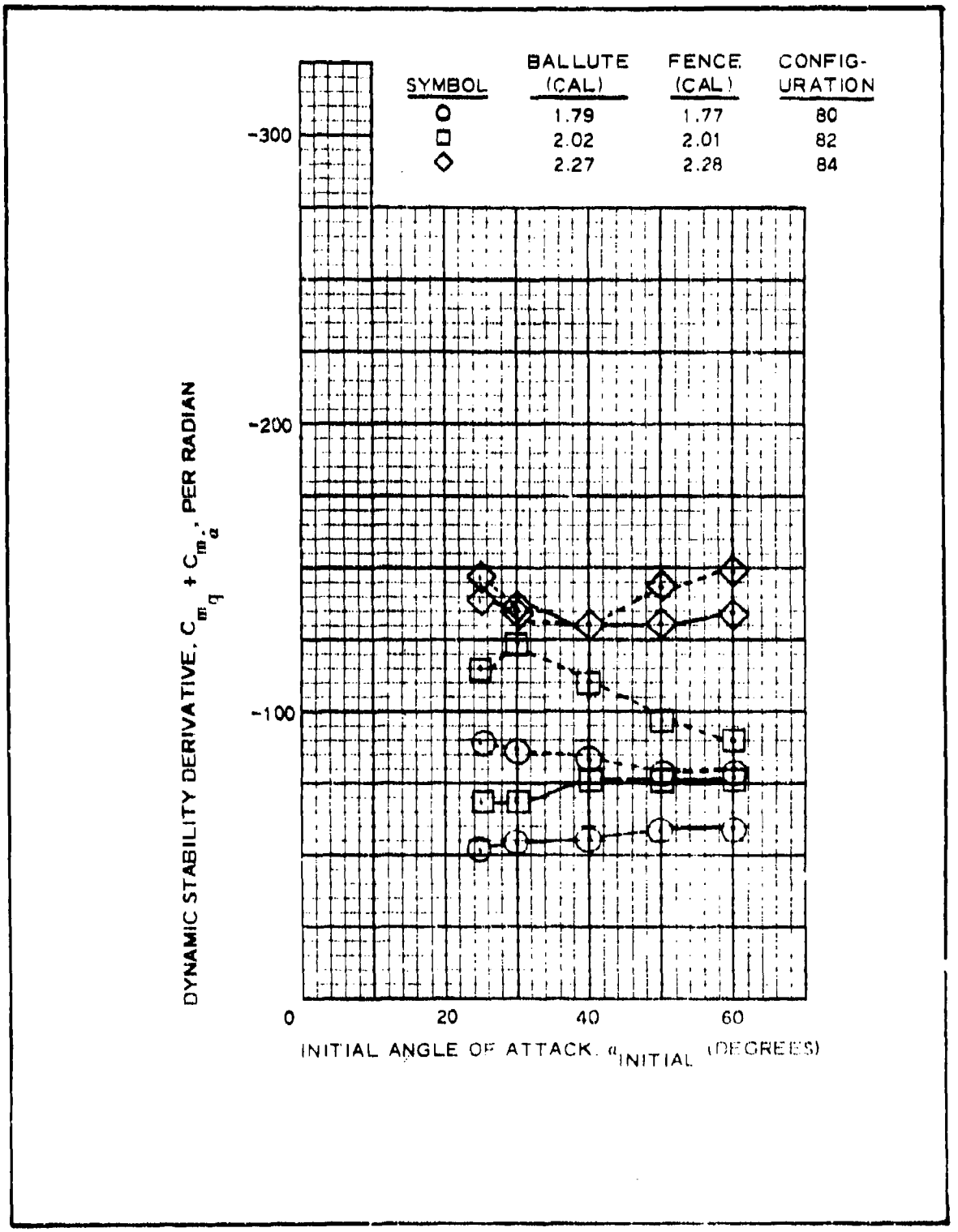


Figure 257. Effect of Ballute Size on Dynamic Stability of 5.0-Caliber Bomb

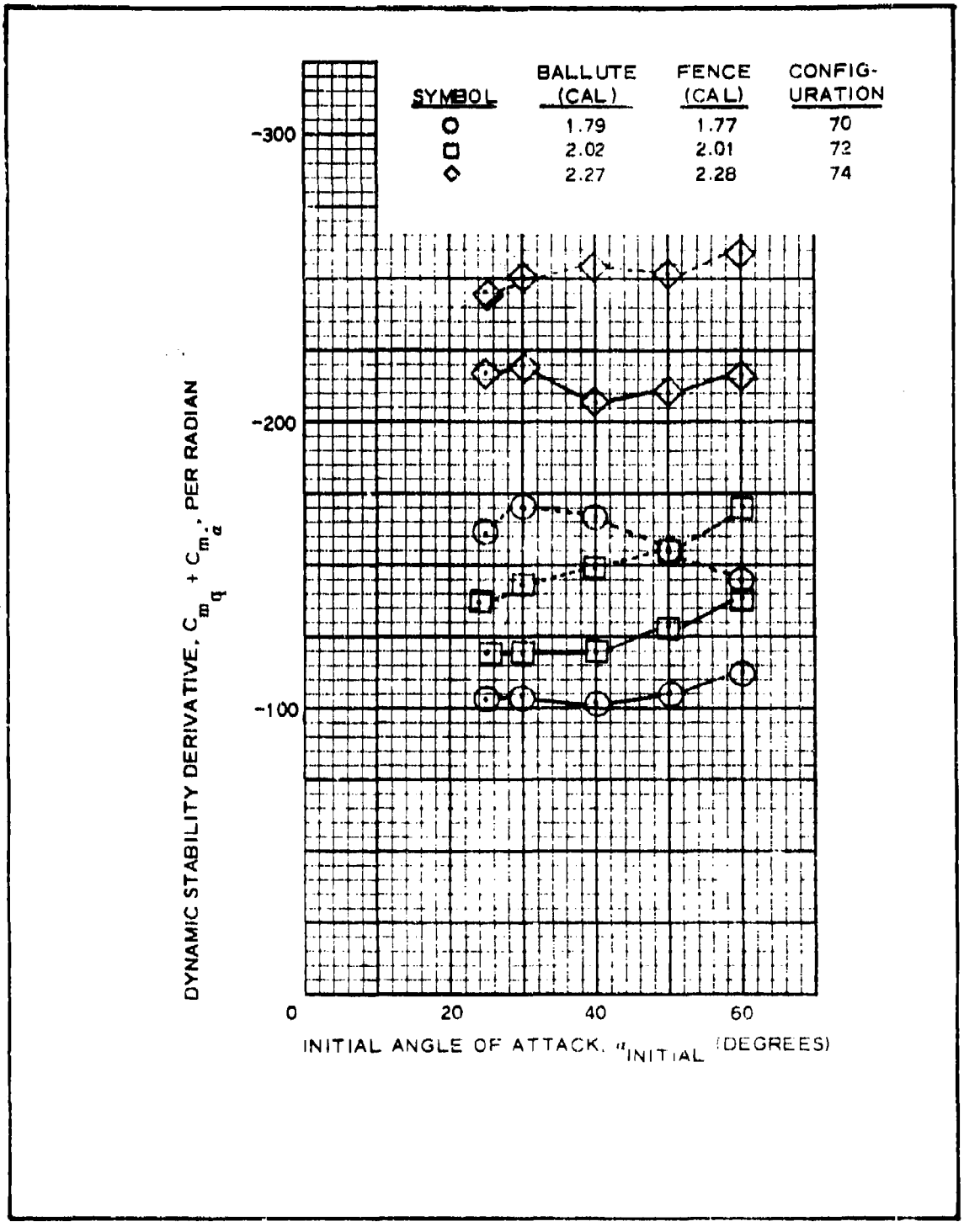


Figure 258. Effect of Ballute Size on Dynamic Stability of 7.0-Caliber Bomb

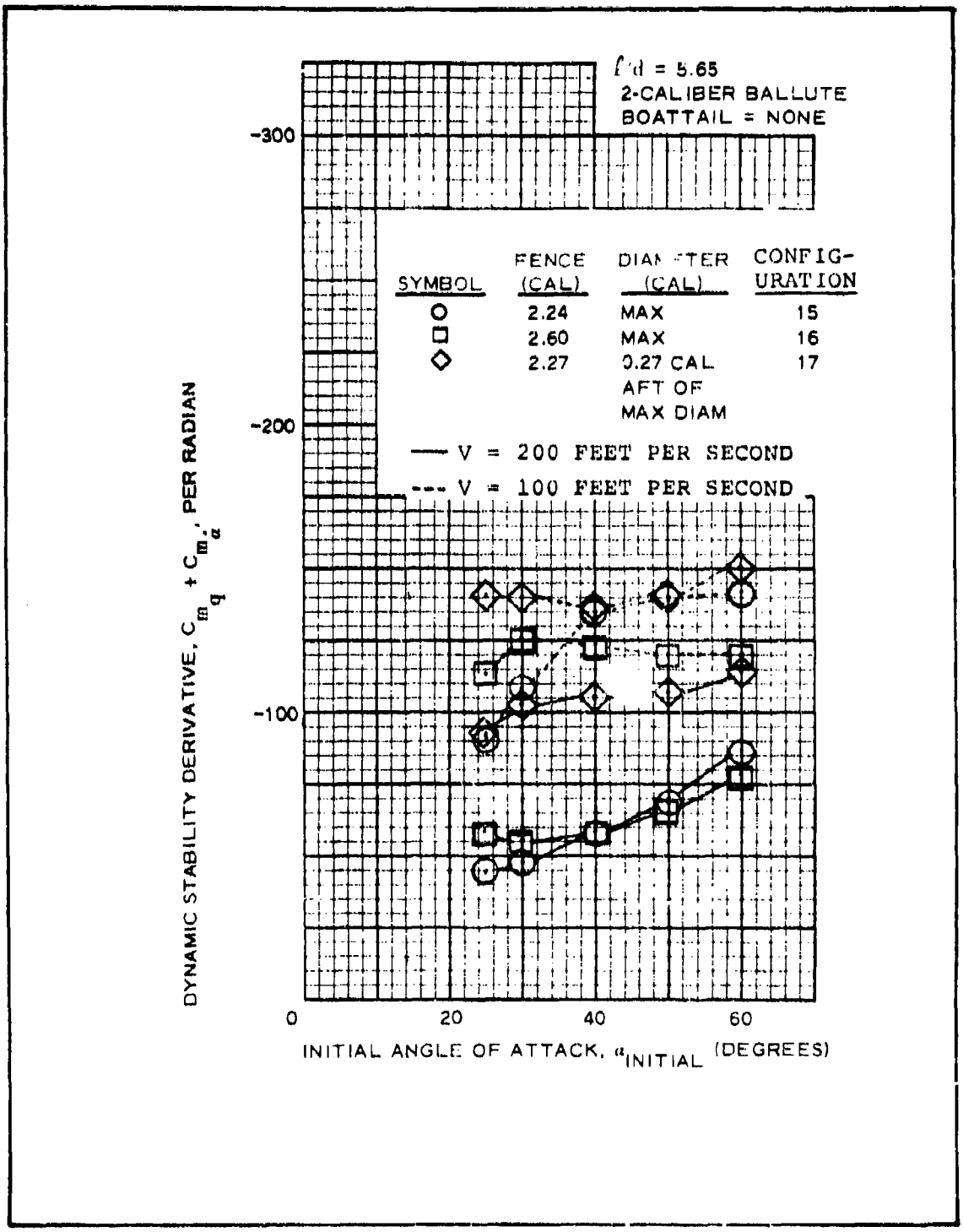


Figure 259. Effect of Ballute Burble Fence Variables on Dynamic Stability of 5.65-Caliber Bomb

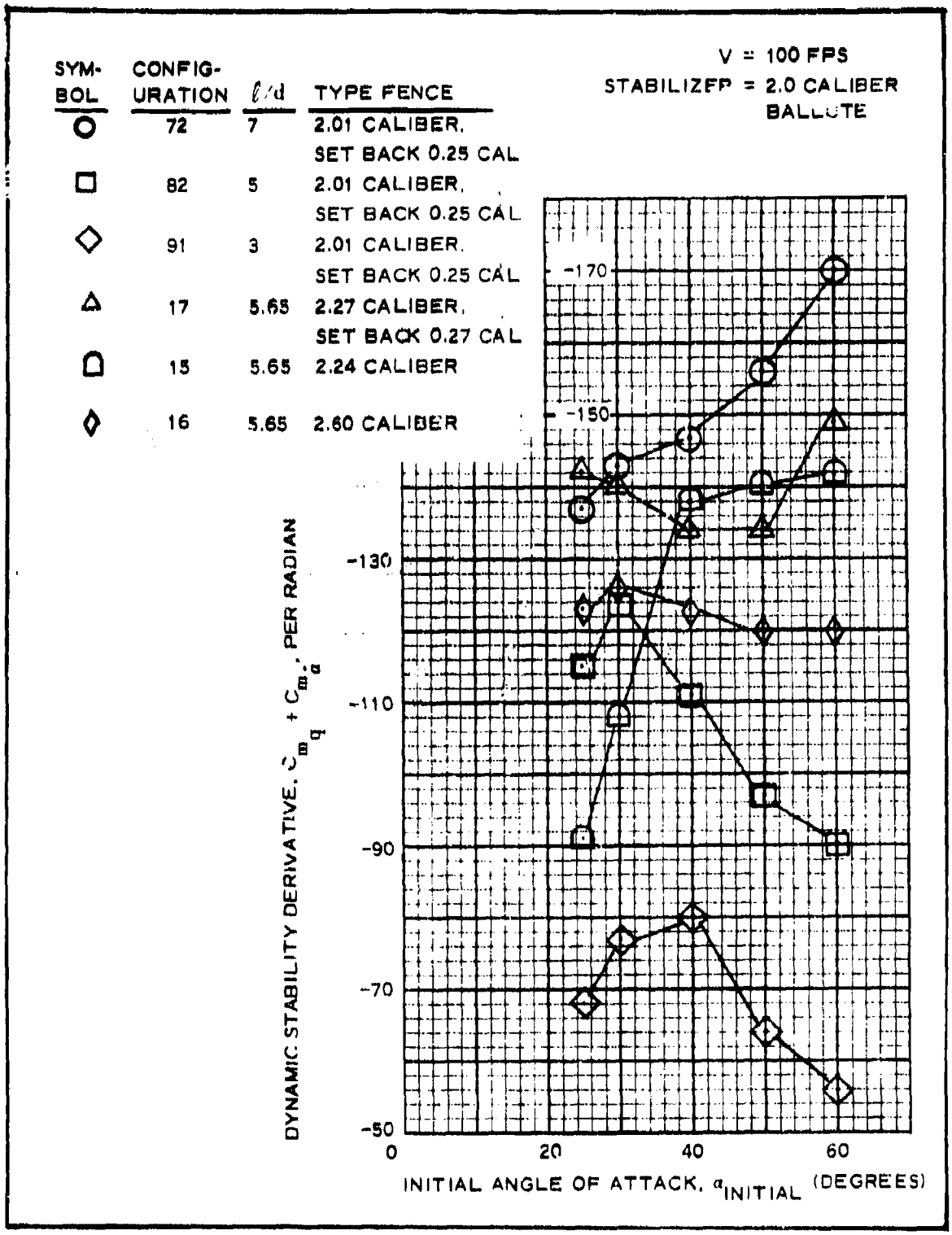


Figure 260. Combined Effects of Fineness Ratio and Burble Fence on Dynamic Stability: V = 100 FPS, Stabilizer = 2.0-Caliber Ballute

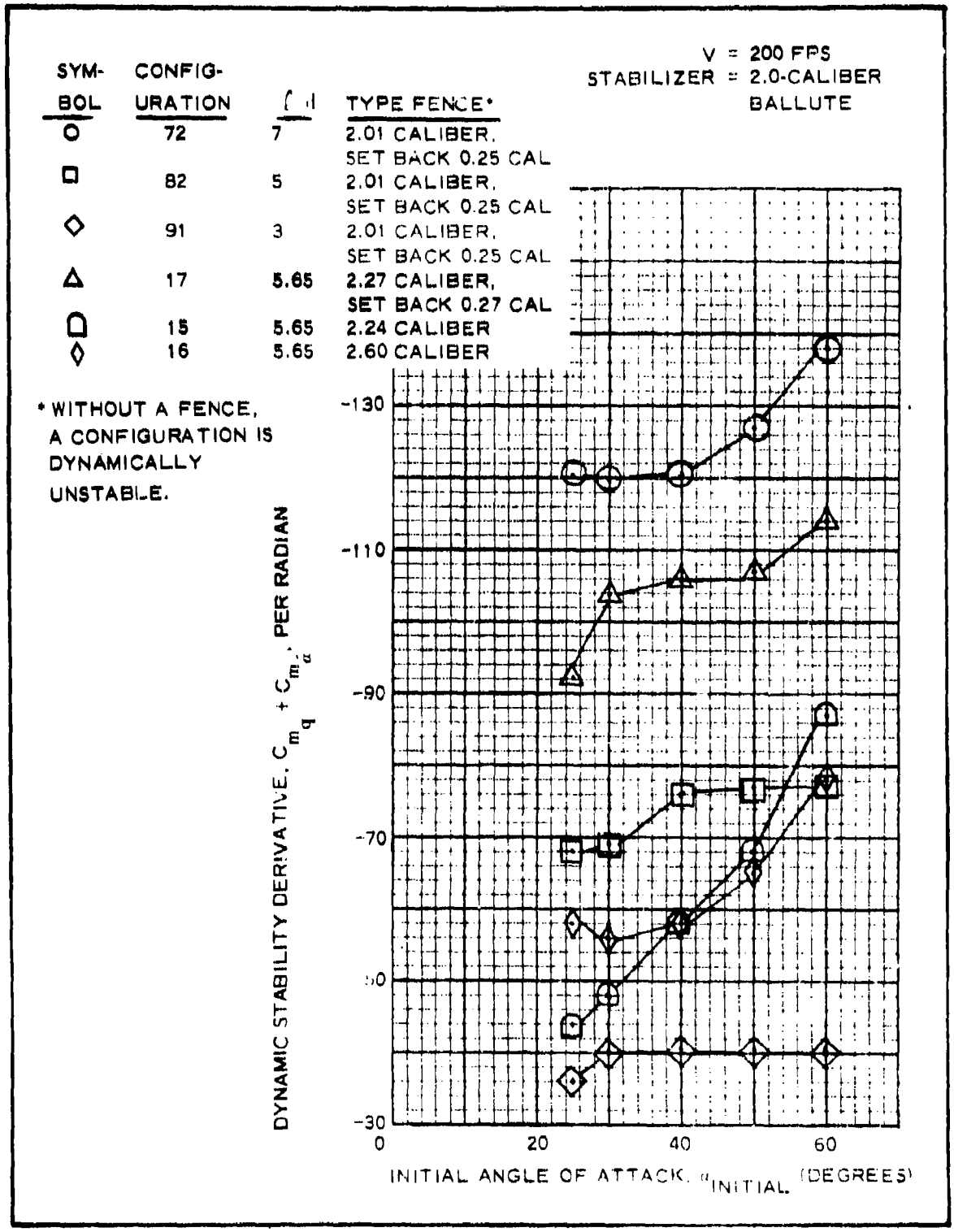


Figure 261. Combined Effects of Fineness Ratio and Burble Fence on Dynamic Stability: V = 200 FPS, Stabilizer = 2.0-Caliber Ballute

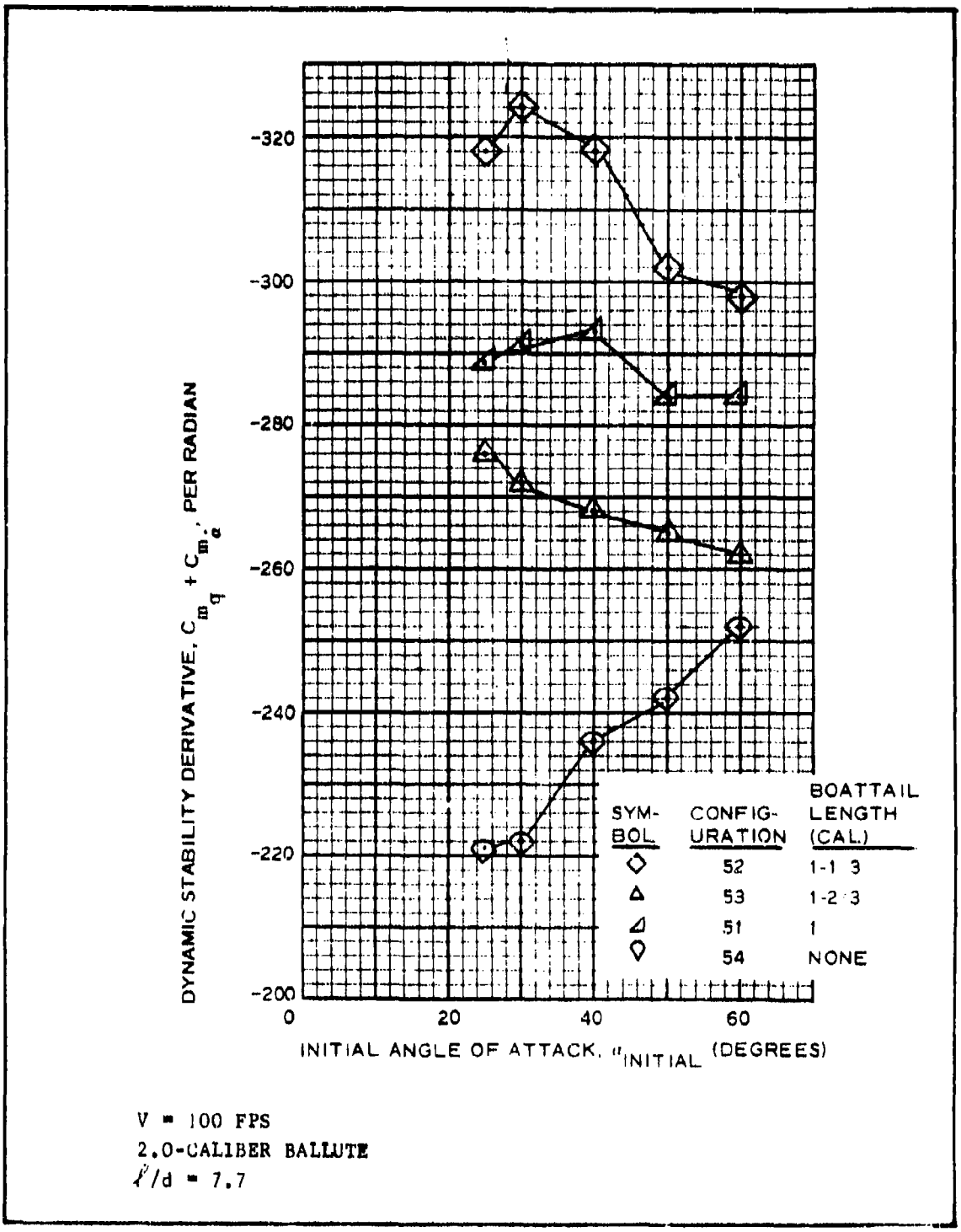


Figure 262. Effects of Boattail Length on Dynamic Stability: V = 100 FPS, 2.0-Caliber Ballute ℓ/d = 7.7

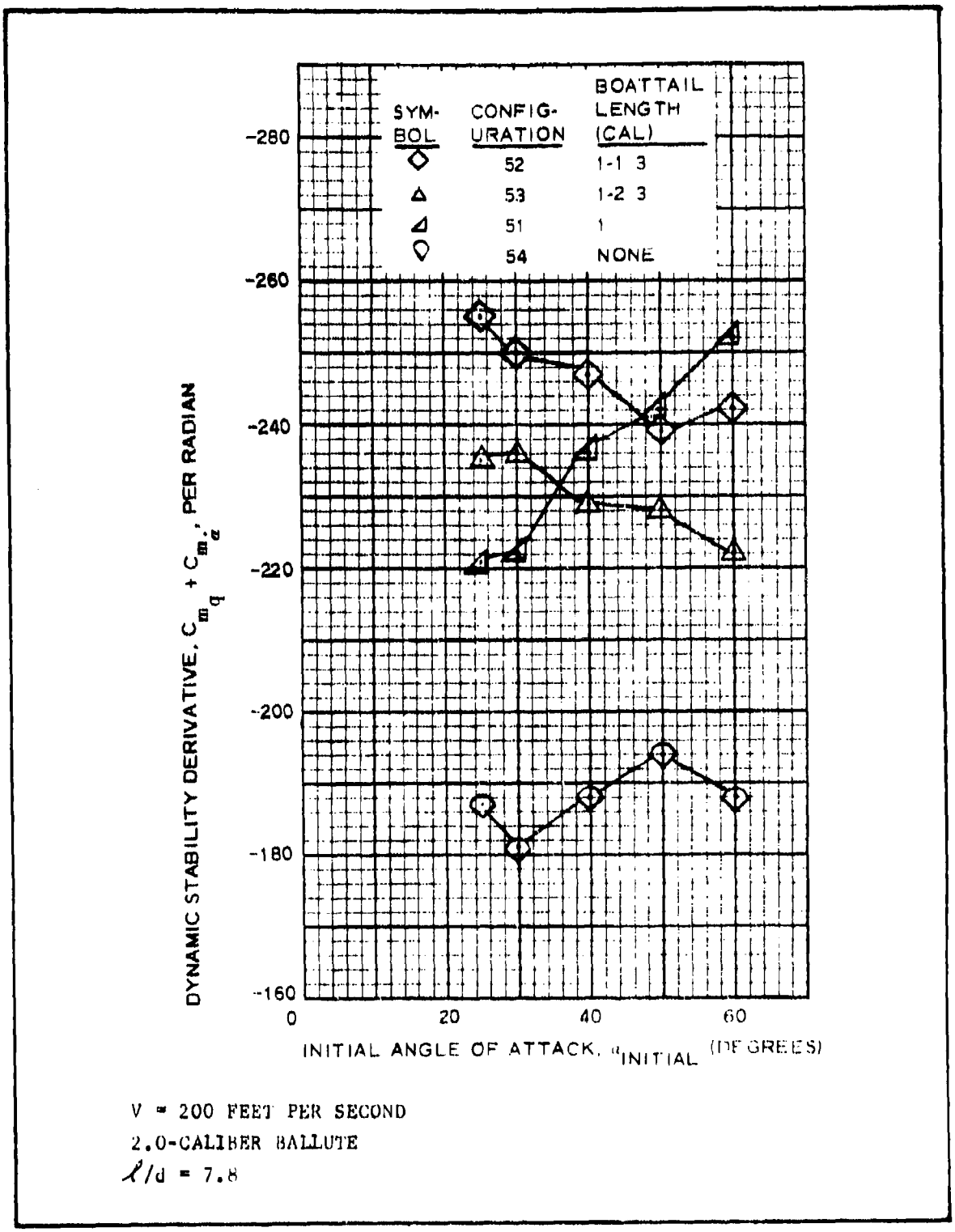


Figure 263. Effects of Boattail Length on Dynamic Stability: V = 200 Feet per Second, 2.0-Caliber Ballute ℓ/d = 7.8

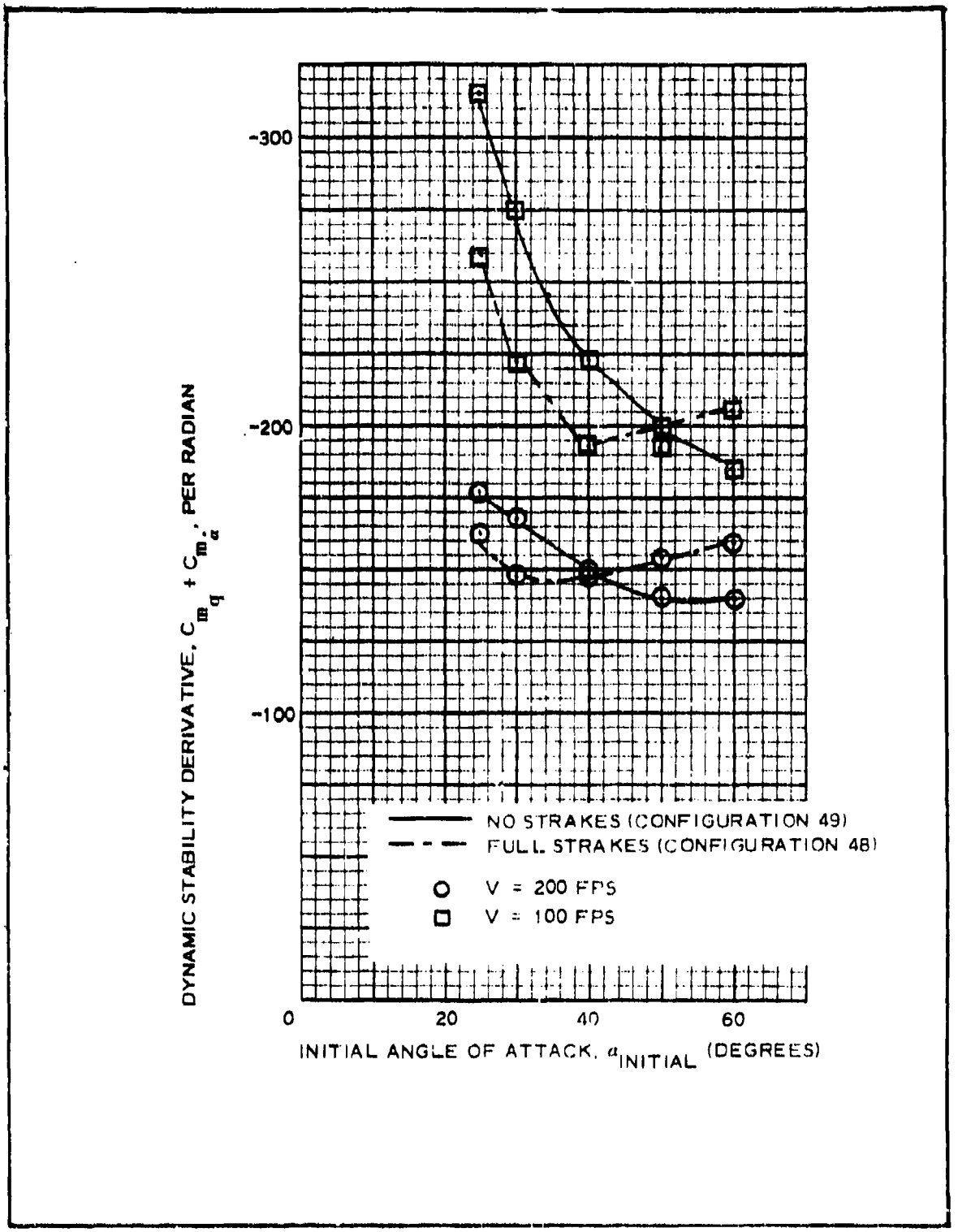


Figure 264. Effects of Boattail Strakes on Dynamic Stability: 1-1/2-Caliber Ballute, 1-Caliber Boattail, $\ell/d = 7.7$

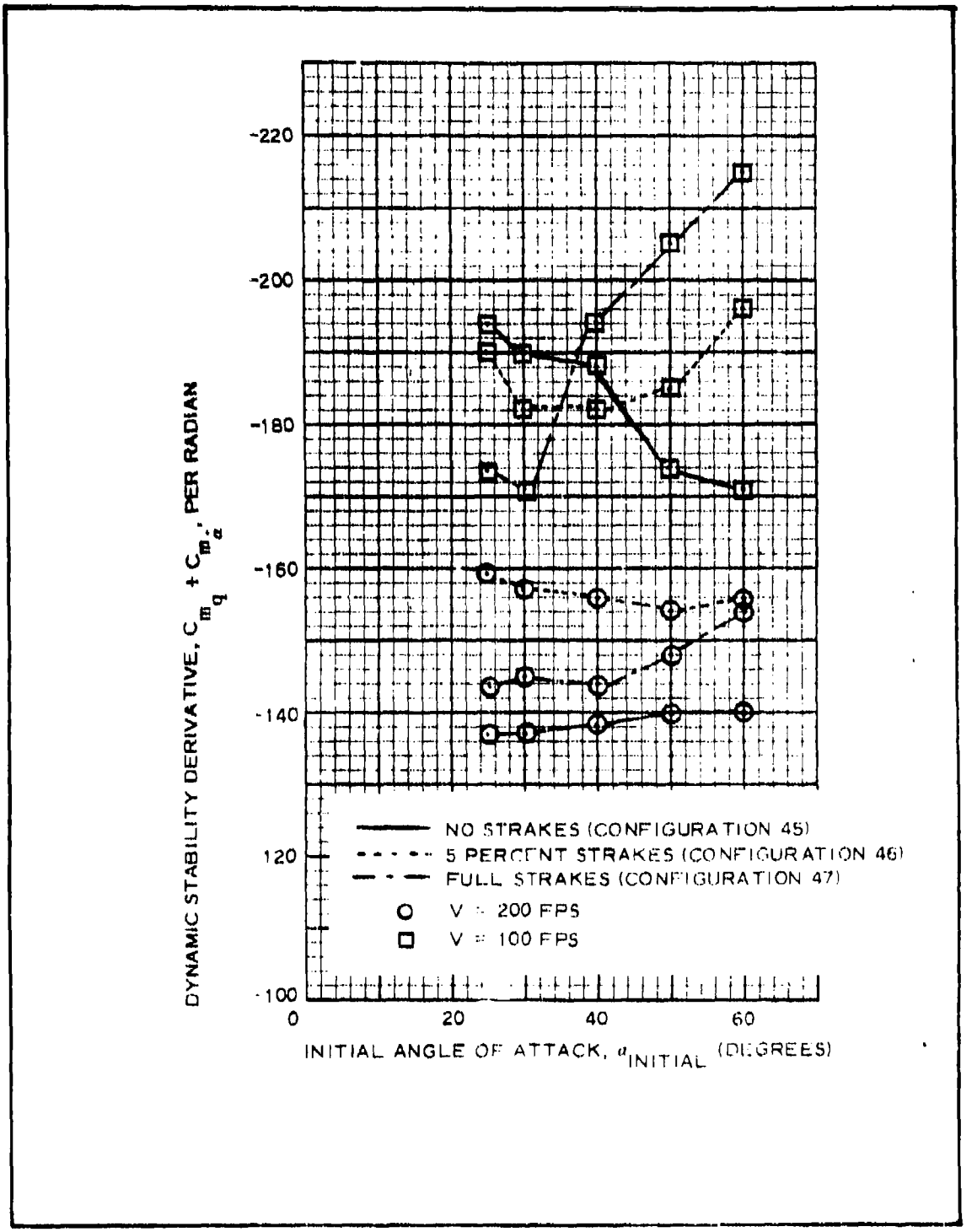


Figure 265. Effects of Boattail Strakes on Dynamic Stability: 1-1 '2-Caliber Ballute, 1-2 '3-Caliber Boattail, 2.0-Caliber Ogive Nose, ℓ/d 7.7

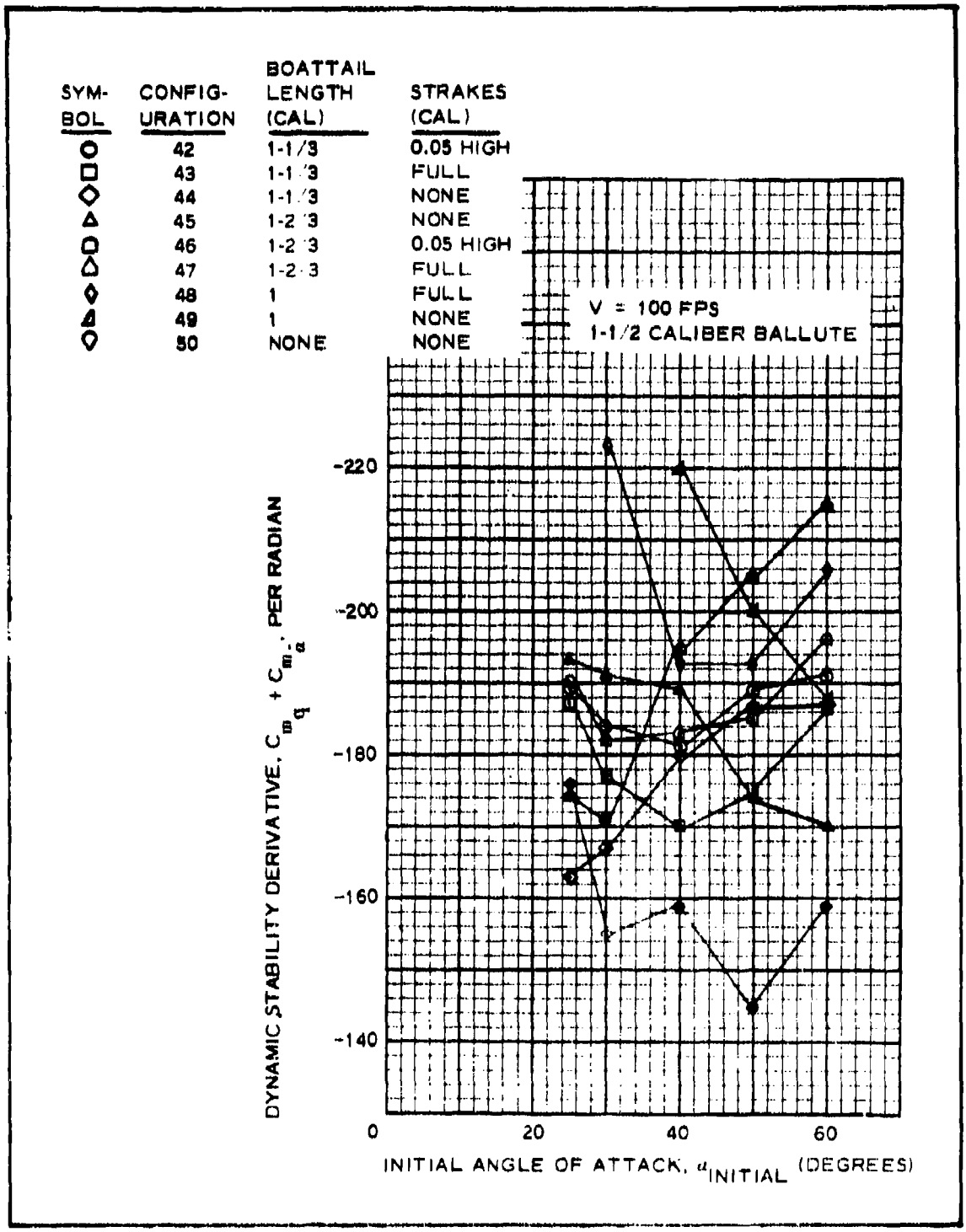


Figure 266. Effect of Various Boattail Characteristics on Dynamic Stability: V = 100 FPS, 1-1/2-Caliber Ballute

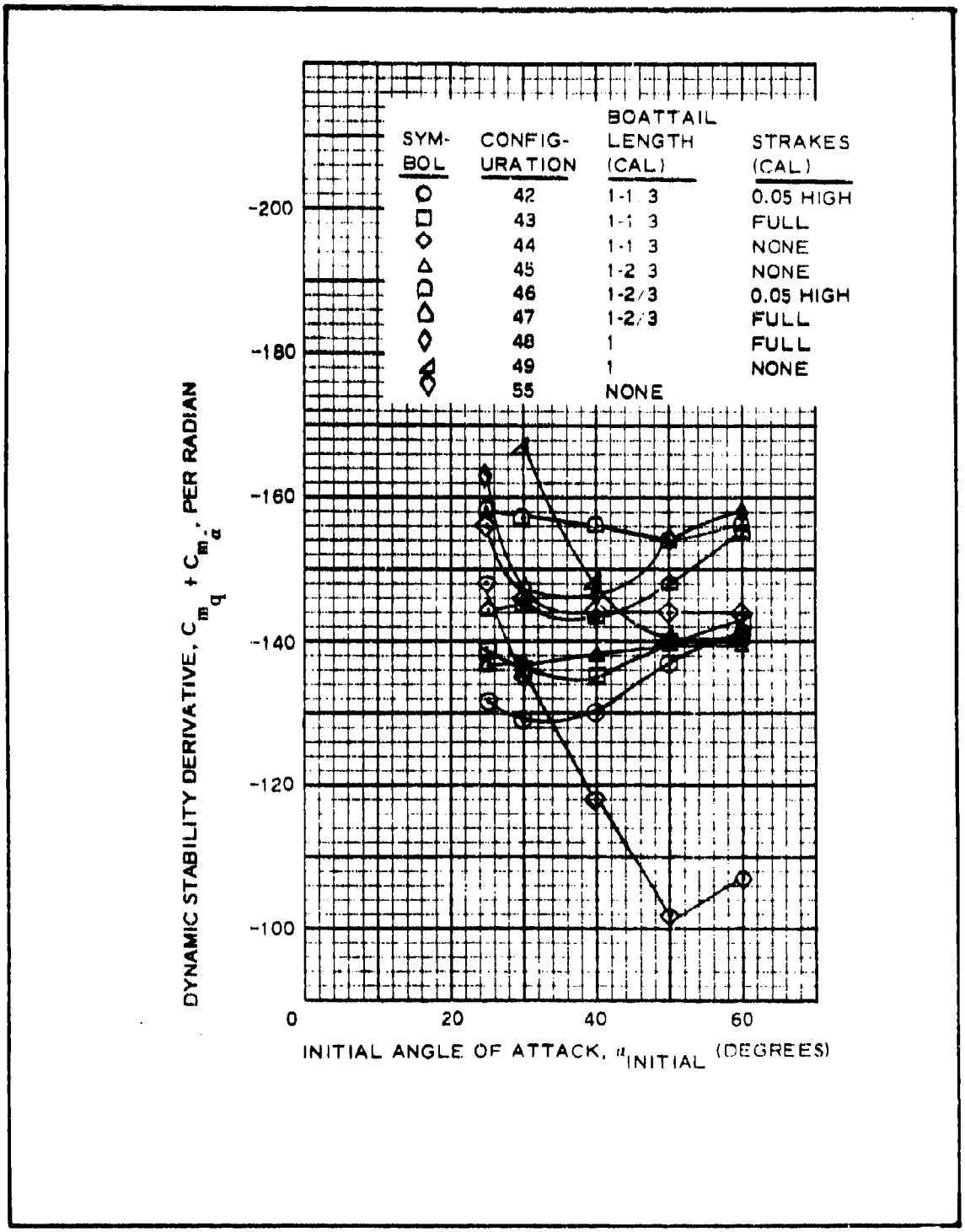
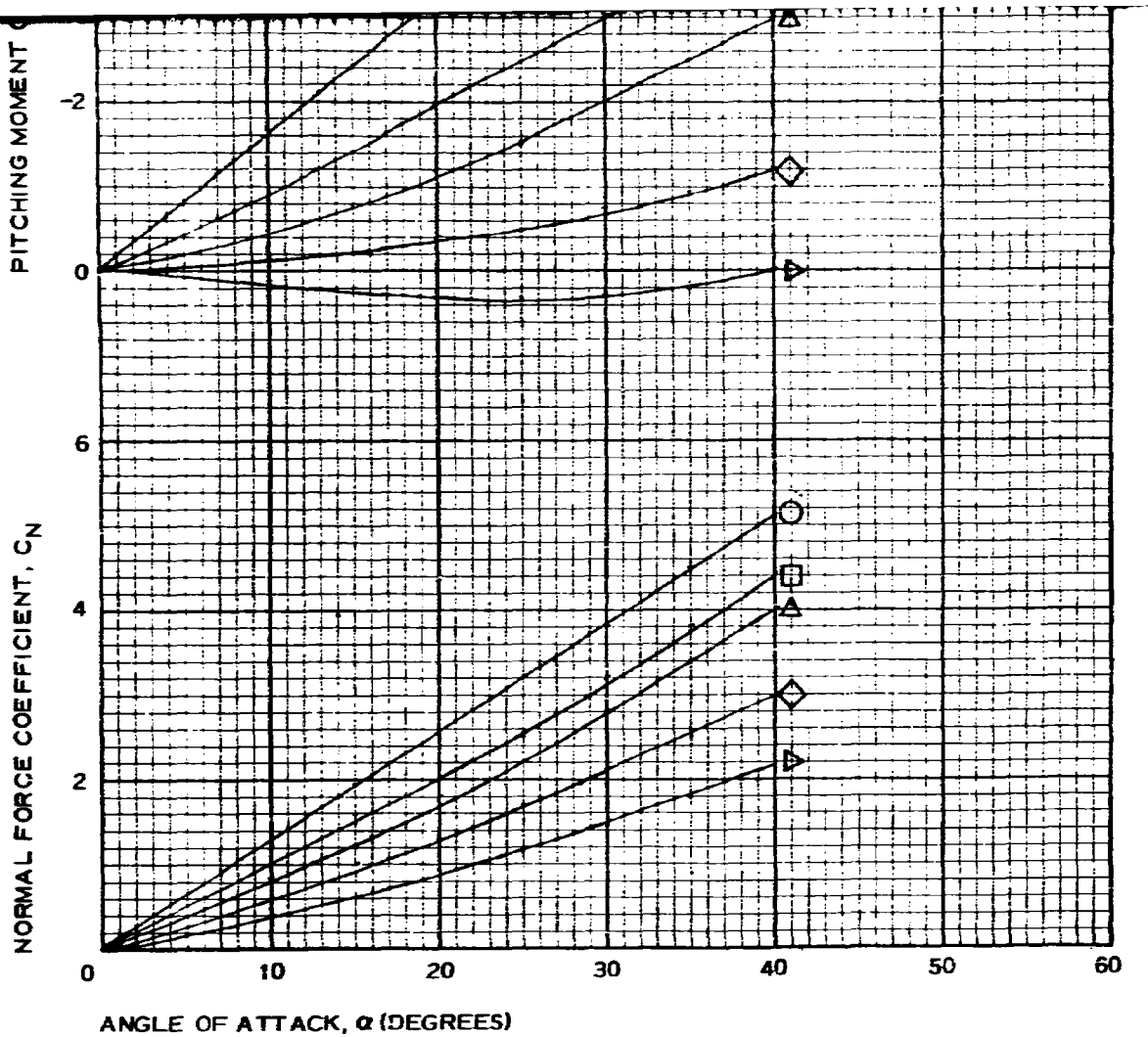


Figure 267. Effects of Various Boattail Characteristics on Dynamic Stability: V 200 FPS, 1-1 2-Caliber Ballute



SYM-BOL	CONFIG-URATION	BALLUTE (CAL)	AFT FENCE (CAL)
	93	2.27	2.28
	91	2.02	2.01
	89	1.79	1.77
	87	1.55	1.50
	95	NO BALLUTE	

$$S_{REF} = \frac{\pi D^2}{4}\ CYLINDER$$

$$\ell_{REF} = D_{CYLINDER}$$

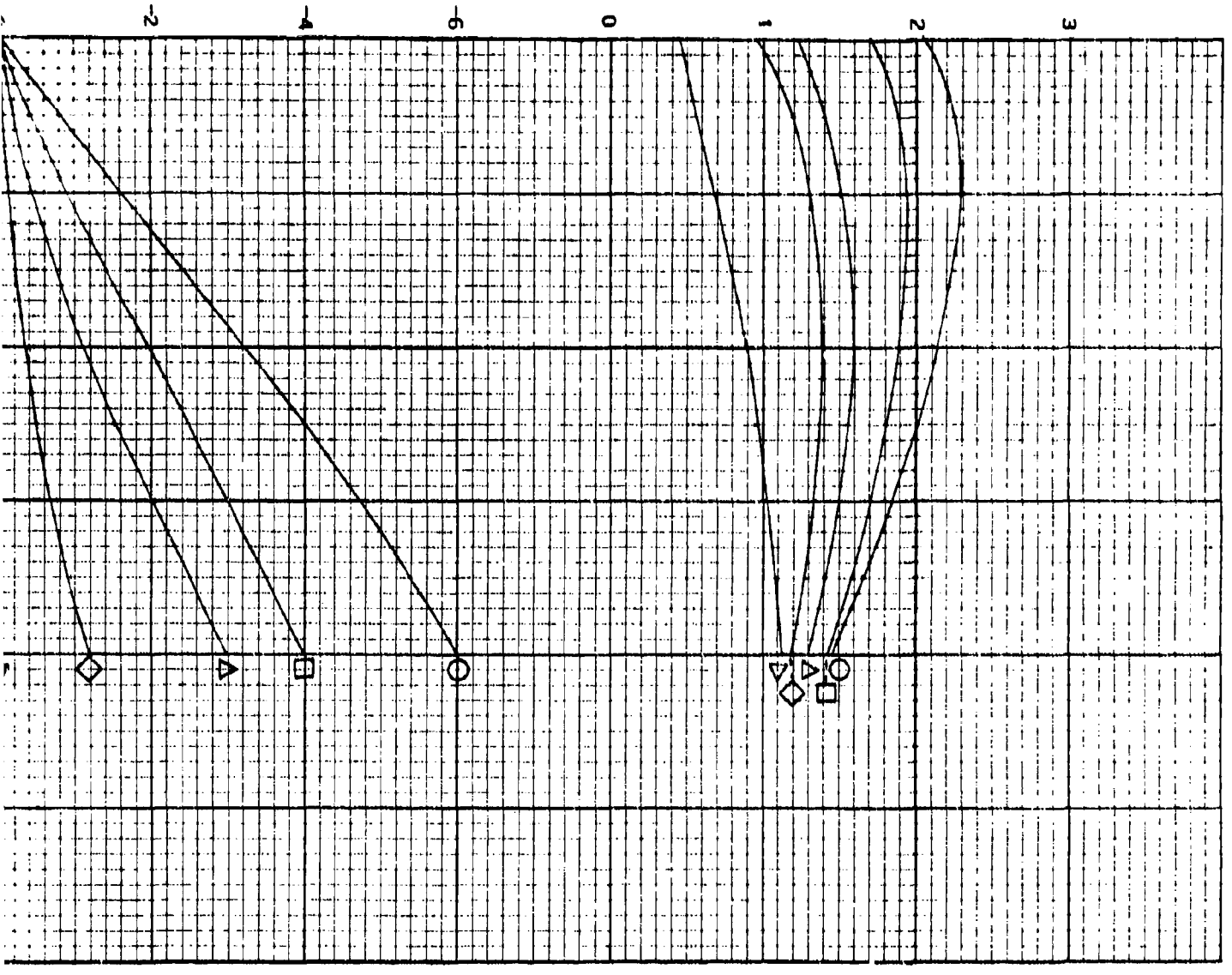


Figure 268. Effect of Ballute Size on Static Aerodynamics of 3.0-Caliber Flat-Nosed Bomb with 1.1 Caliber Trip and Ballute Stabilizer with Fence

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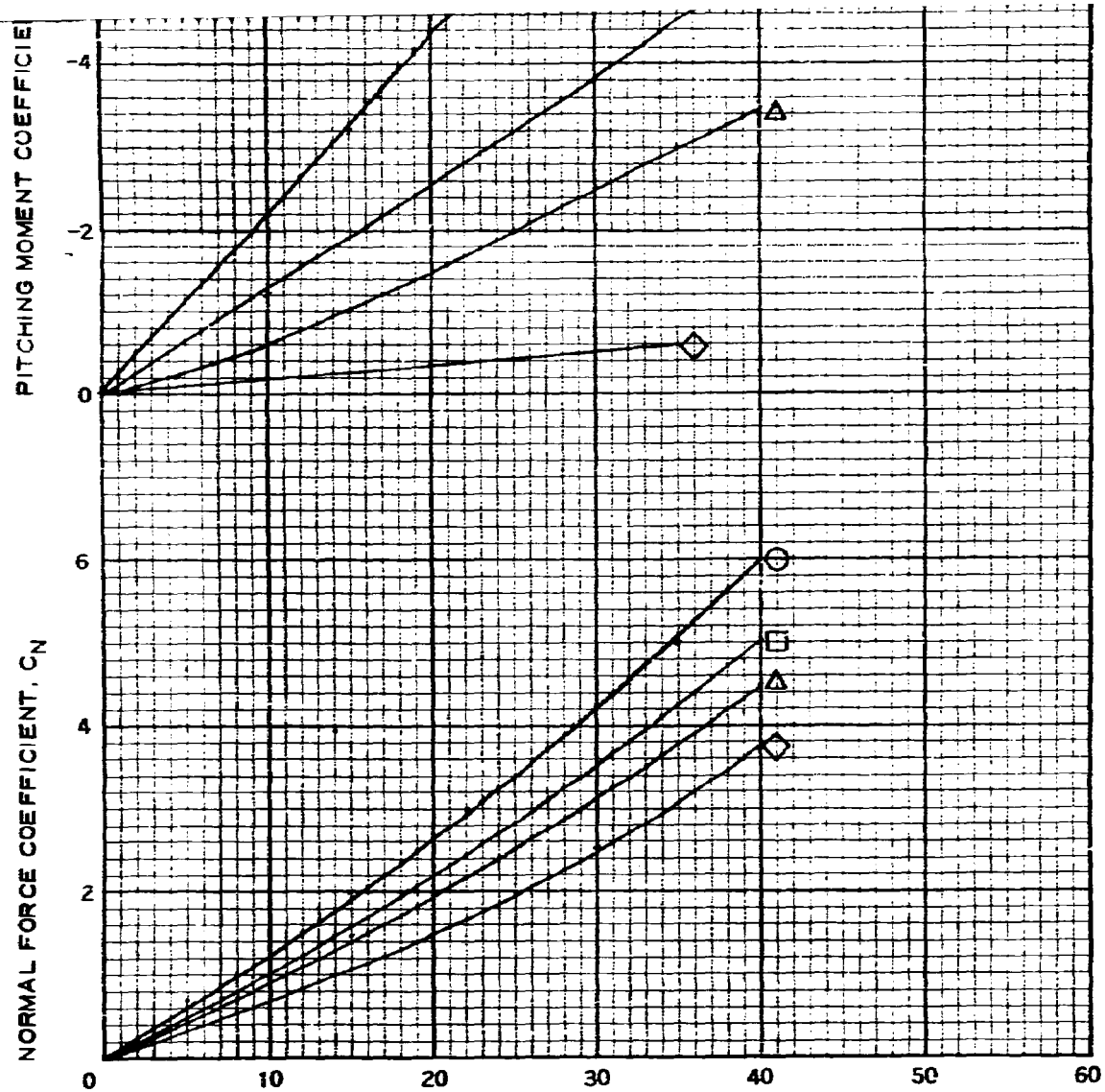

SYM-BOL	CONFIG-URATION	BALLUTE (CAL)	AFT FENCE (CAL)
	84	2.27	2.28
	82	2.02	2.01
	80	1.79	1.77
	78	1.55	1.50

$$S_{REF} = \frac{\pi D^2}{4} \text{ CYLINDER}$$

$$\ell_{REF} = D_{CYLINDER}$$

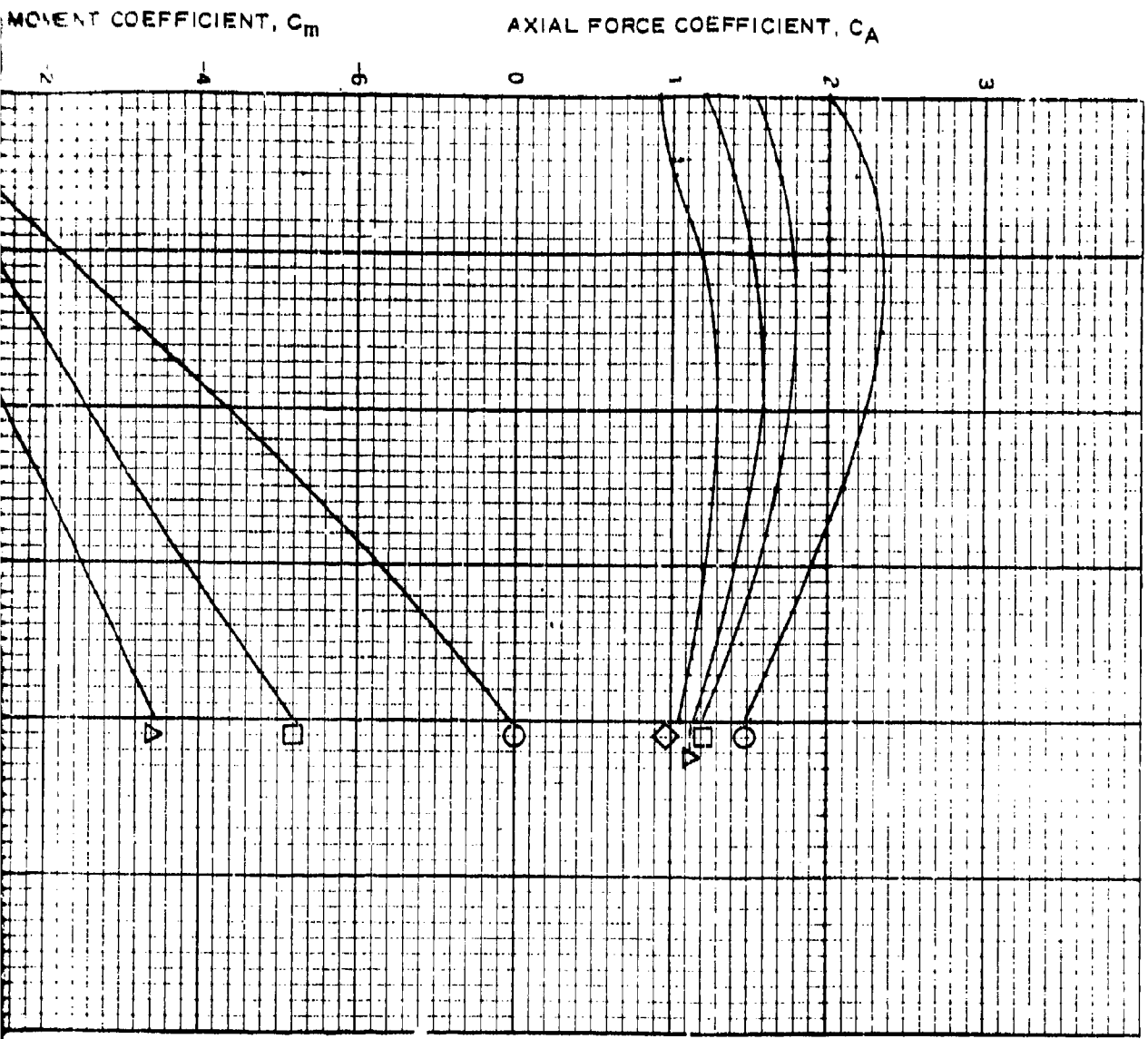

Figure 269. Effect of Ballute Size on Static Aerodynamics of 5.0-Caliber Flat-Nosed Bomb with 1.1-Caliber Trip Ring and Ballute Stabilizer with Fence

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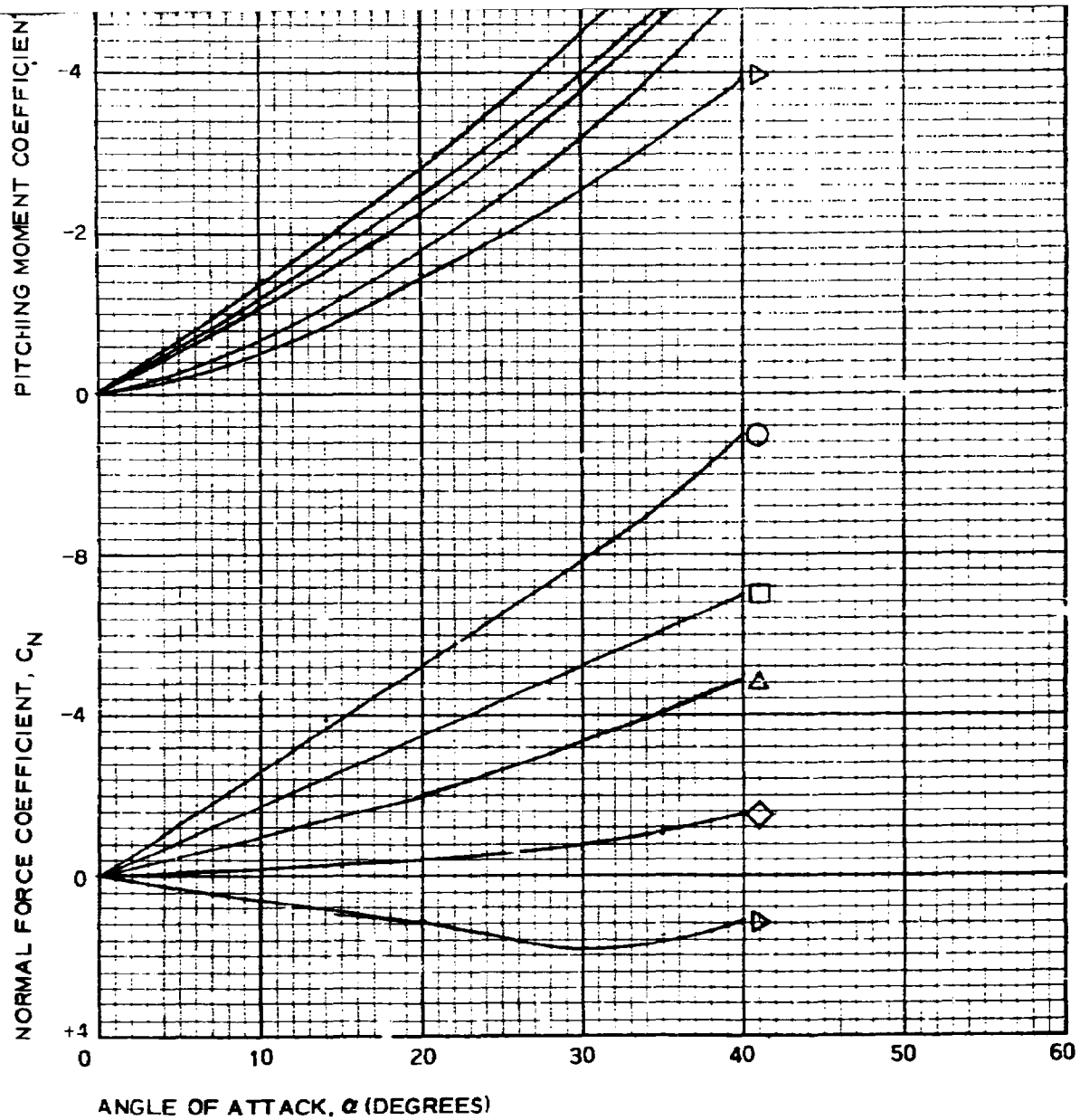

$S_{REF} = \frac{\pi D^2}{4}$ CYLINDER

$\ell_{REF} = D$ CYLINDER

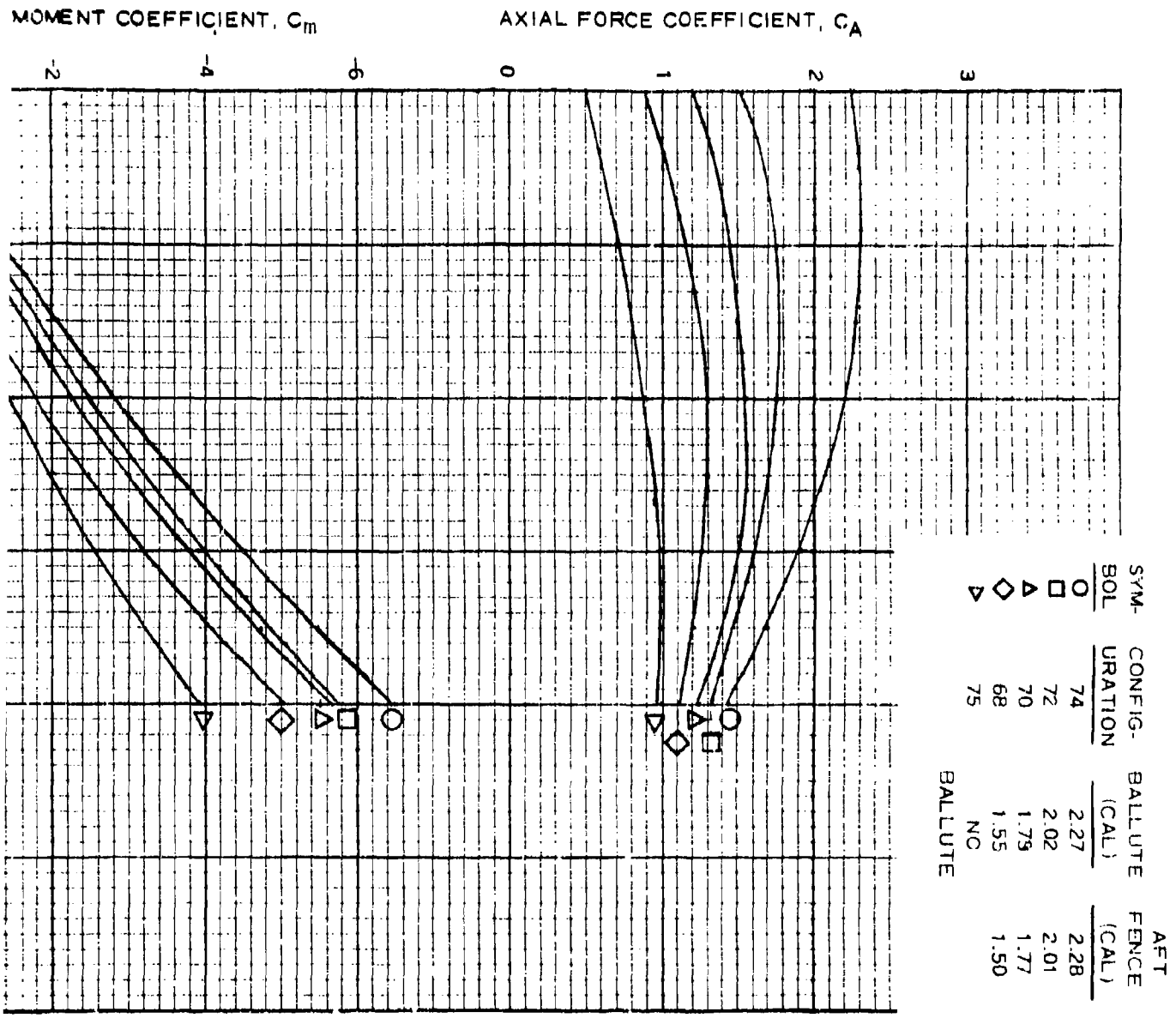

Figure 270. Effect of Ballute Size on Static Aerodynamics of 7.0-Caliber Flat-Nosed Bomb with 1.1-Caliber Trip Ring and Ballute Stabilizer with Fence

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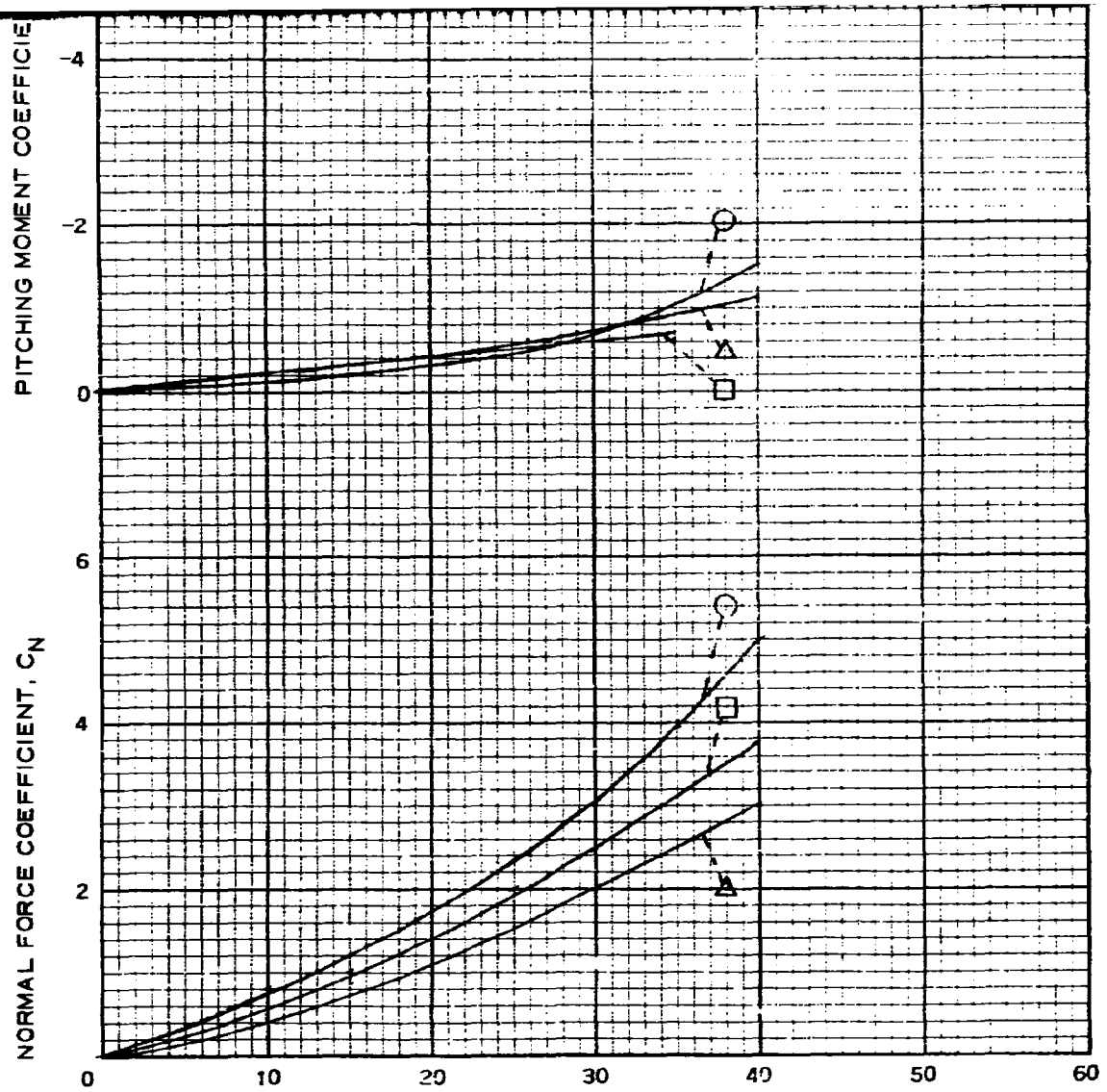

SYM-BOL	CONFIG-URATION	ℓ/d
○	68	7.0
□	78	5.0
△	87	3.0

$$S_{REF} = \frac{\pi D^2}{4} \text{ CYLINDER}$$

$$\ell_{REF} = D \text{ CYLINDER}$$

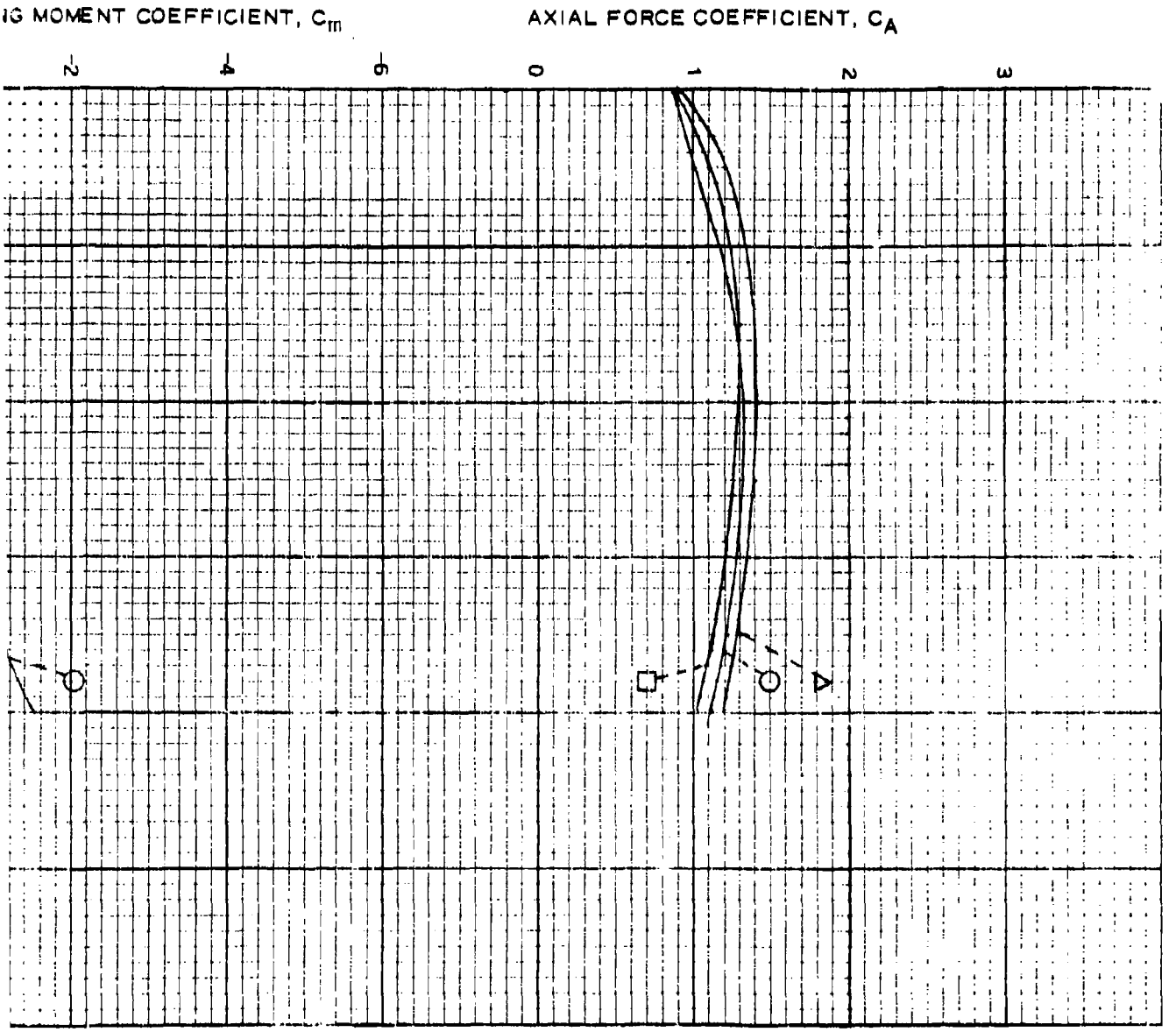

Figure 271. Effect of Fineness Ratio on Static Aerodynamics of Flat-Nosed Bomb with 1.1-Caliber Trip Ring and 1.5-Caliber Ballute Stabilizer with Aft Fence

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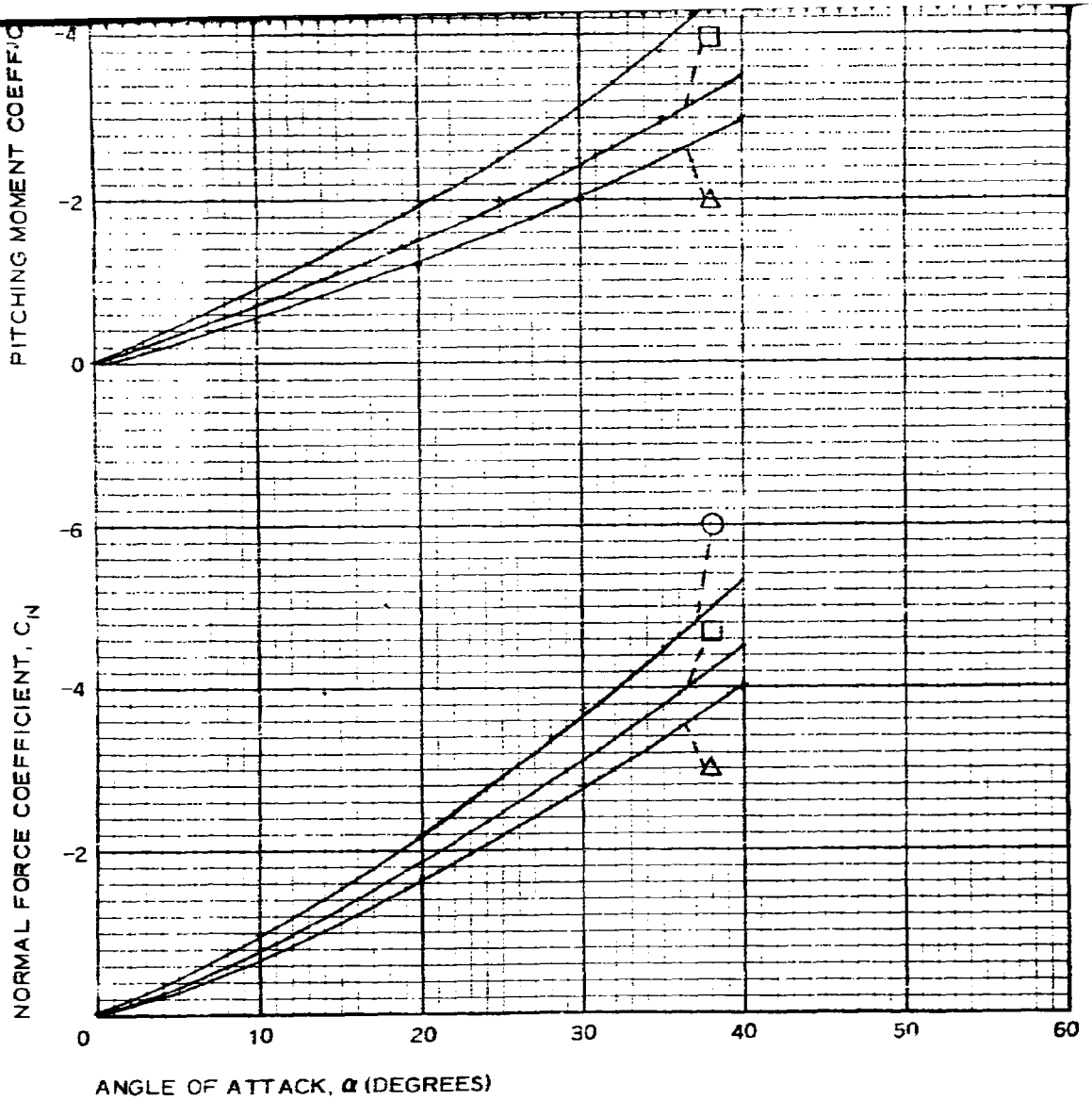

SYM-BOL	CONFIG-URATION	$\frac{L}{d}$
O	70	7.0
□	69	5.0
Δ	89	3.0

$$S_{REF} = \frac{\pi D^2}{4}\ CYLINDER$$

$$L_{REF} = D_{CYLINDER}$$

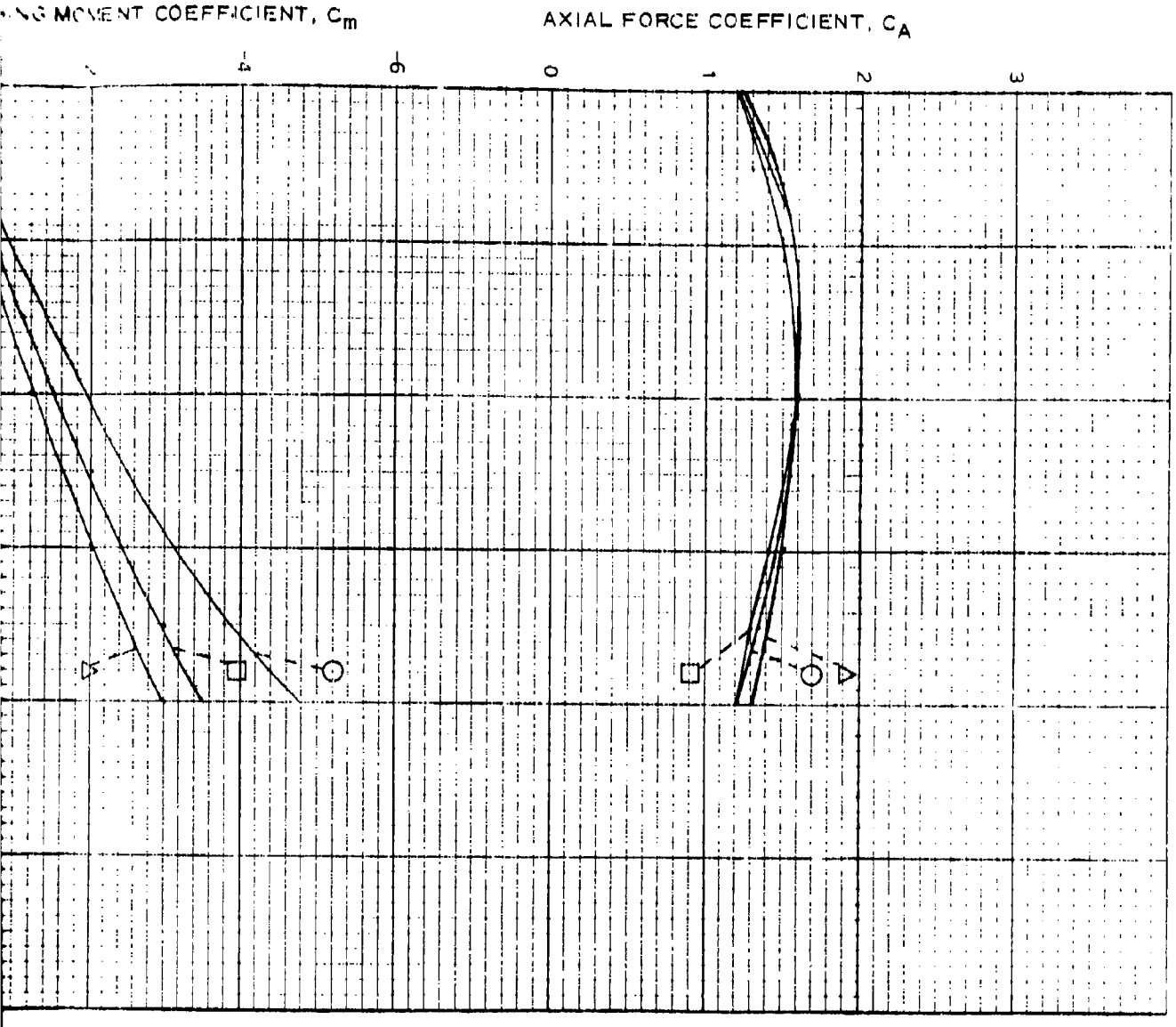

Figure 272. Effect of Fineness Ratio on Static Aerodynamics of Flat-Nosed Bomb with Trip Ring and 1.75 Caliber Ballute Stabilizer with Aft Fence

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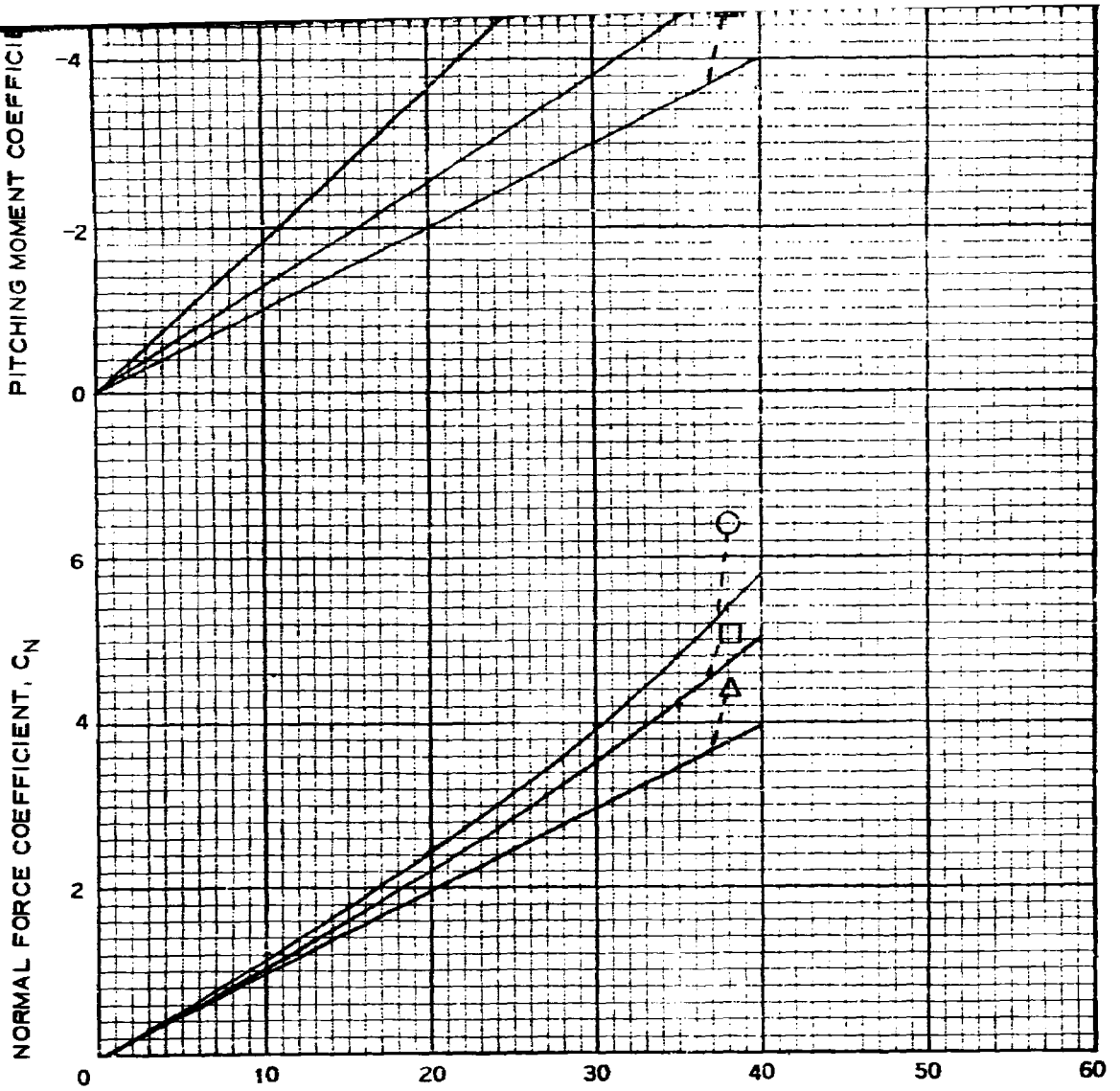

SYM-BOL	CONFIG-URATION	ℓ/d
	72	7.0
	82	5.0
	91	3.0

$$S_{REF} = \frac{\pi D^2}{4}\ \text{CYLINDER}$$

$$\ell_{REF} = D\ \text{CYLINDER}$$

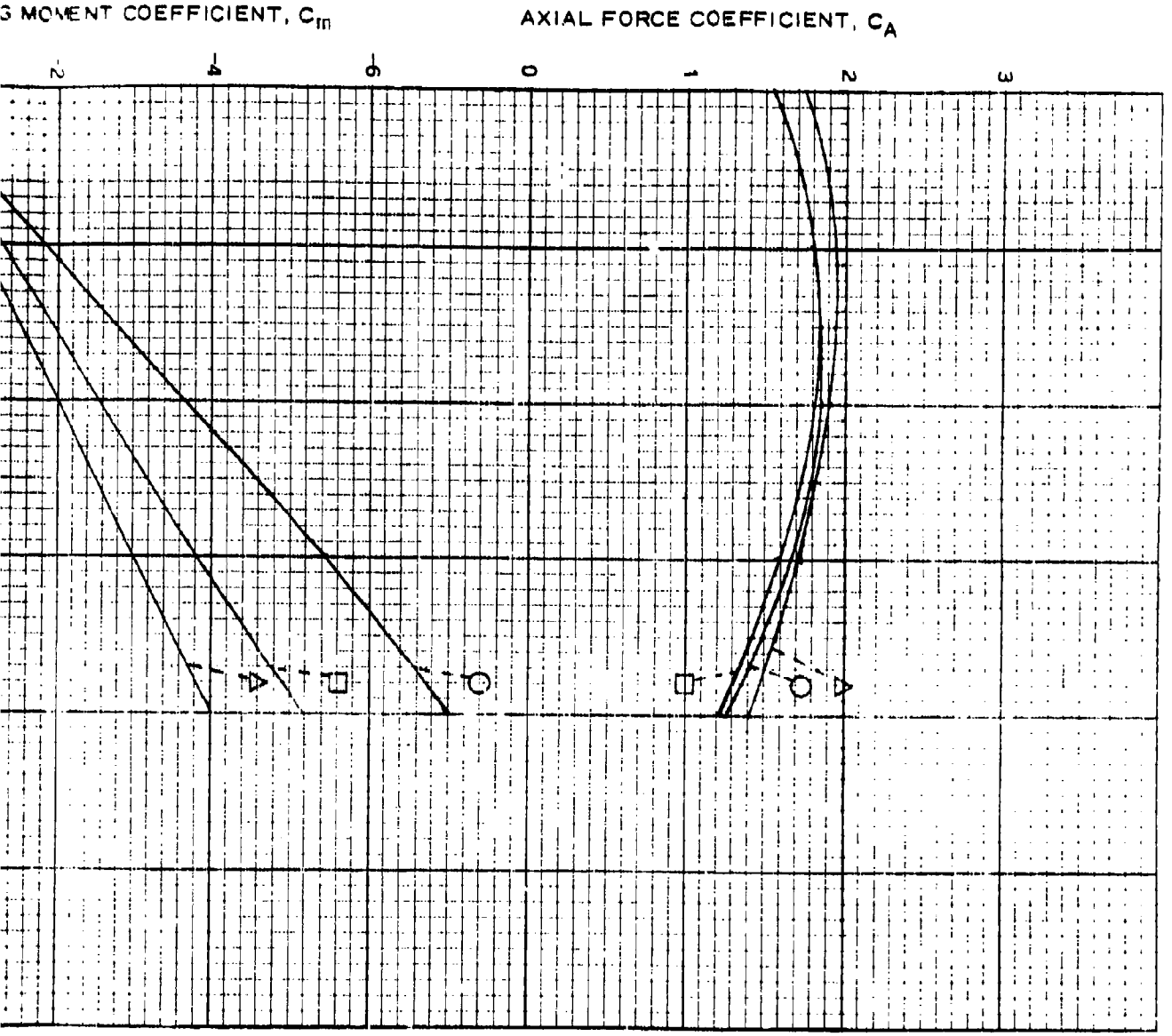

Figure 273. Effect of Fineness Ratio on Static Aerodynamics of Flat-Nosed Bomb with 1.1-Caliber Trip Ring and 2.0-Caliber Ballute with Aft Fence

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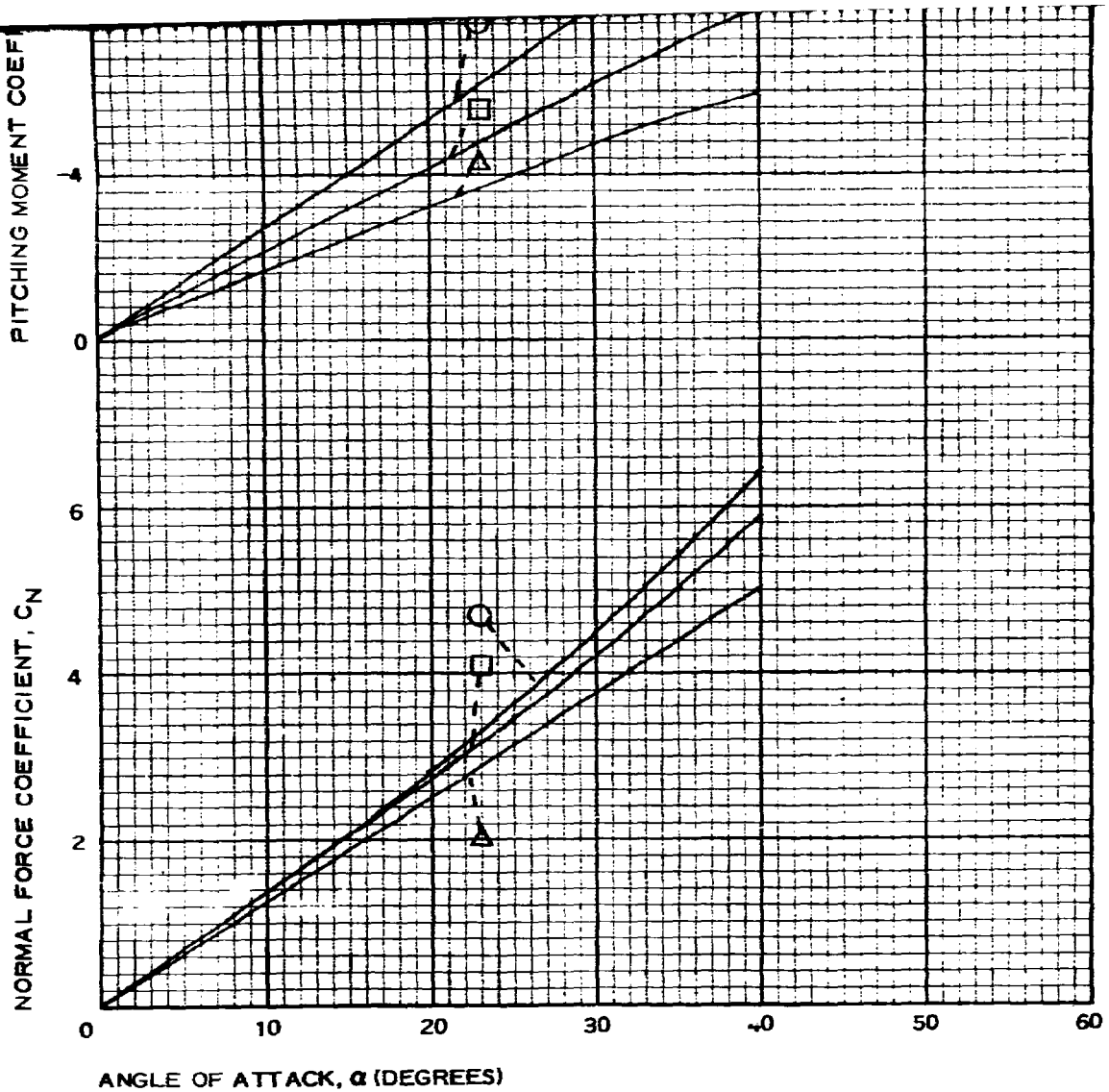

SYMBOL	CONFIGURATION	ℓ/d
	74	7.0
	93	5.0
	84	3.0

$$S_{REF} = \frac{\pi D^2}{4} \text{ CYLINDER}$$

$$\ell_{REF} = D_{CYLINDER}$$

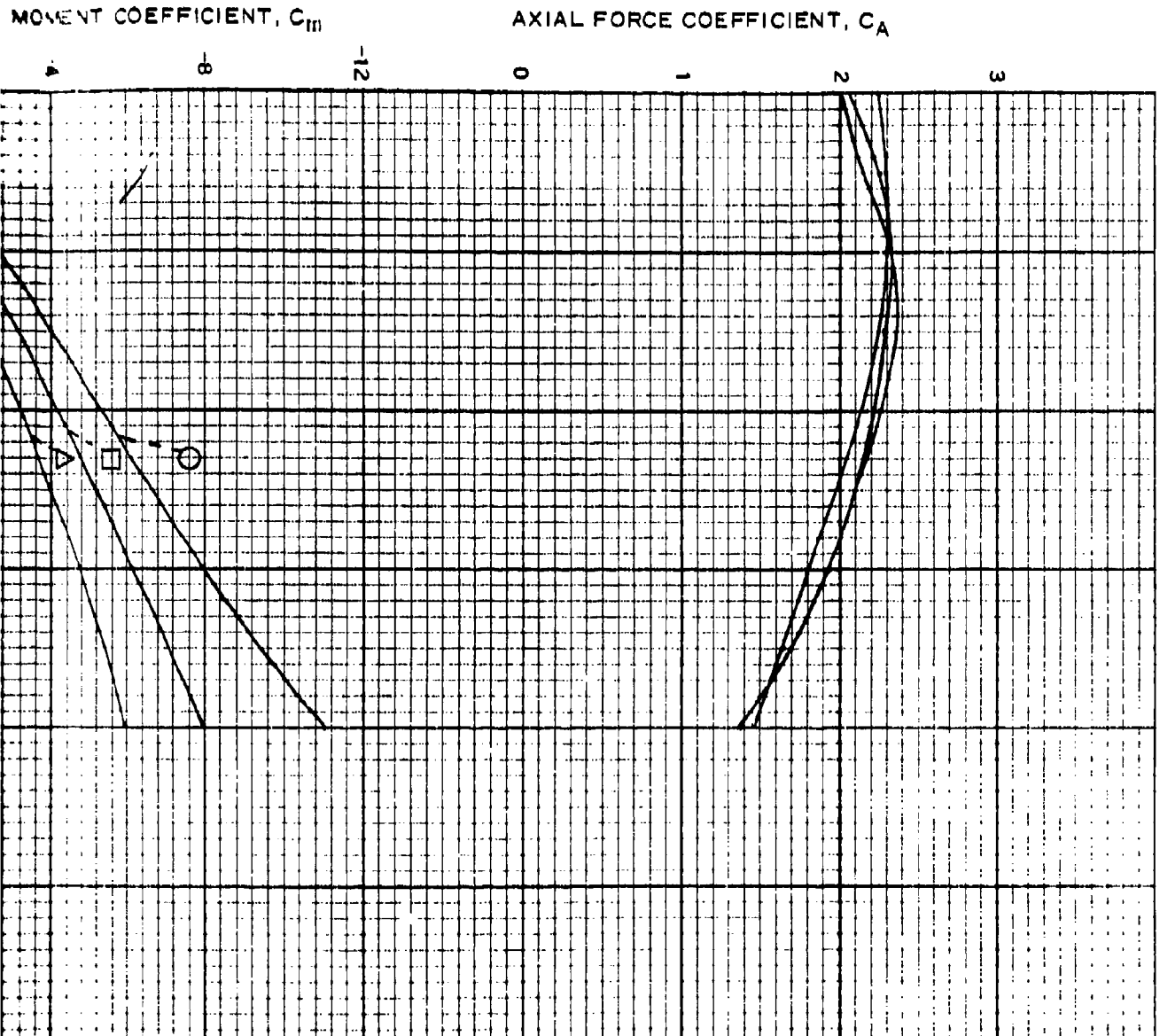

Figure 274. Effect of Fineness Ratio on Static Aerodynamics of Flat-Nosed Bomb with 1.1-Caliber Trip Ring and 2.27-Caliber Ballute with Aft Fence

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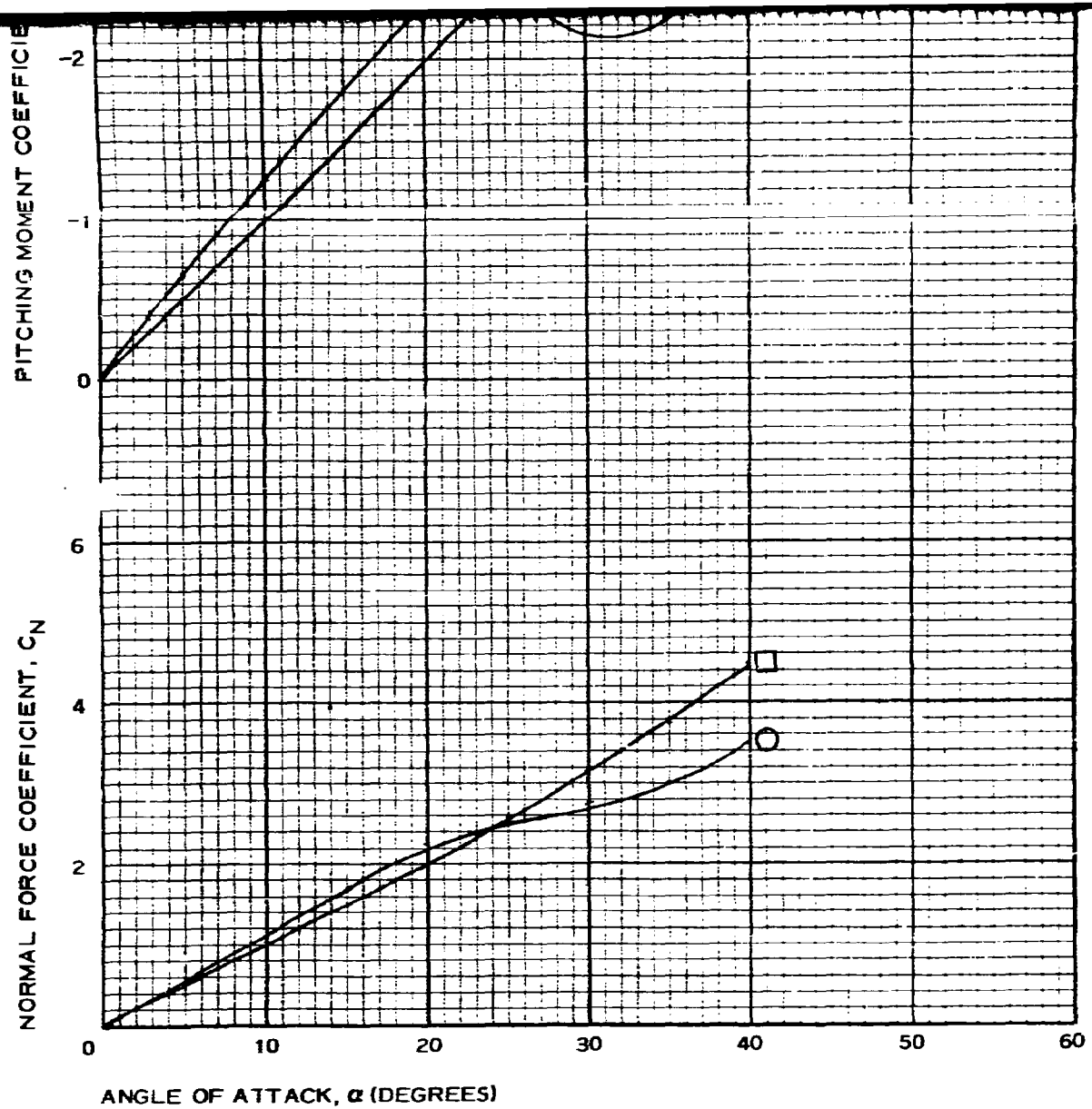

SYMBOL	CONFIGURATION	FENCE TYPE
	90	BURBLE
	91	AFT

$S_{REF} = \frac{\pi D^2}{4}$ CYLINDER

$\ell_{REF} = D_{CYLINDER}$

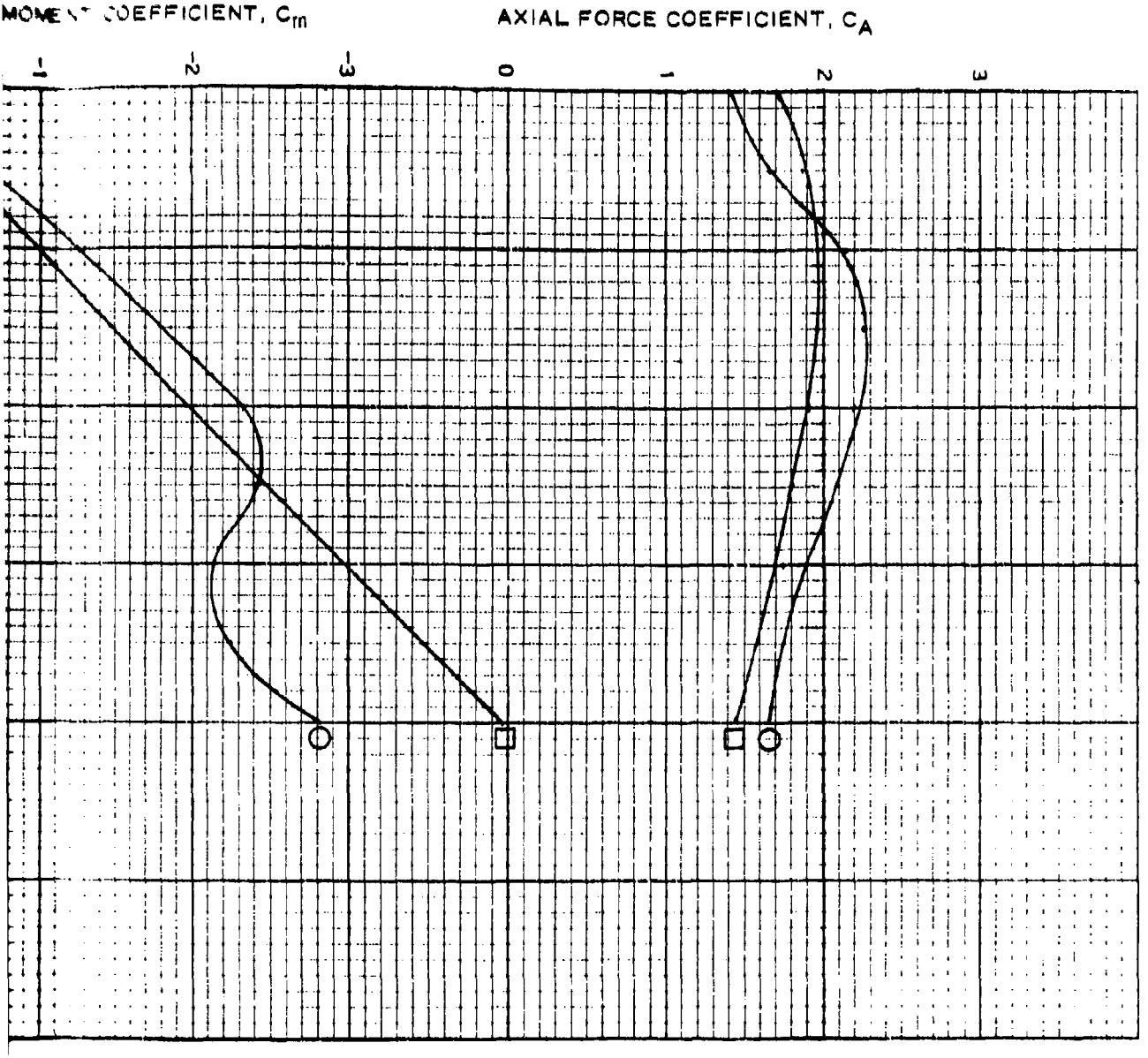

Figure 275. Effect of Burble Fence on the Static Aerodynamics of a 3.0-Caliber Flat-Nosed Bomb with 1.1-Caliber Trip Ring and 2.0-Caliber Ballute Stabilizer

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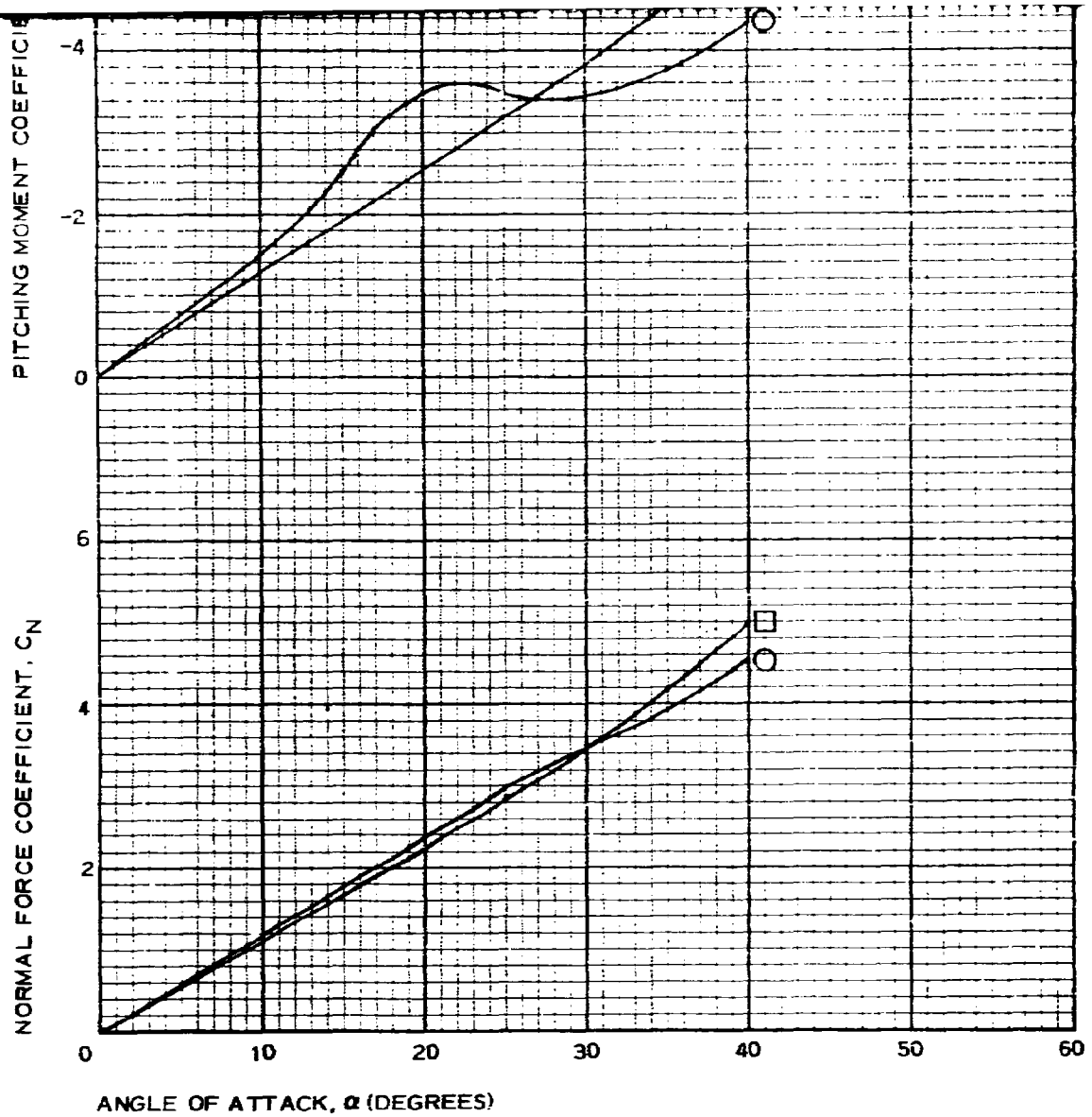

SYM-BOL	CONFIG-URATION	FENCE TYPE
	81	BURBLE
	82	AFT

$S_{REF} = \frac{\pi D^2}{4}$ CYLINDER

$\ell_{REF} = D_{CYLINDER}$

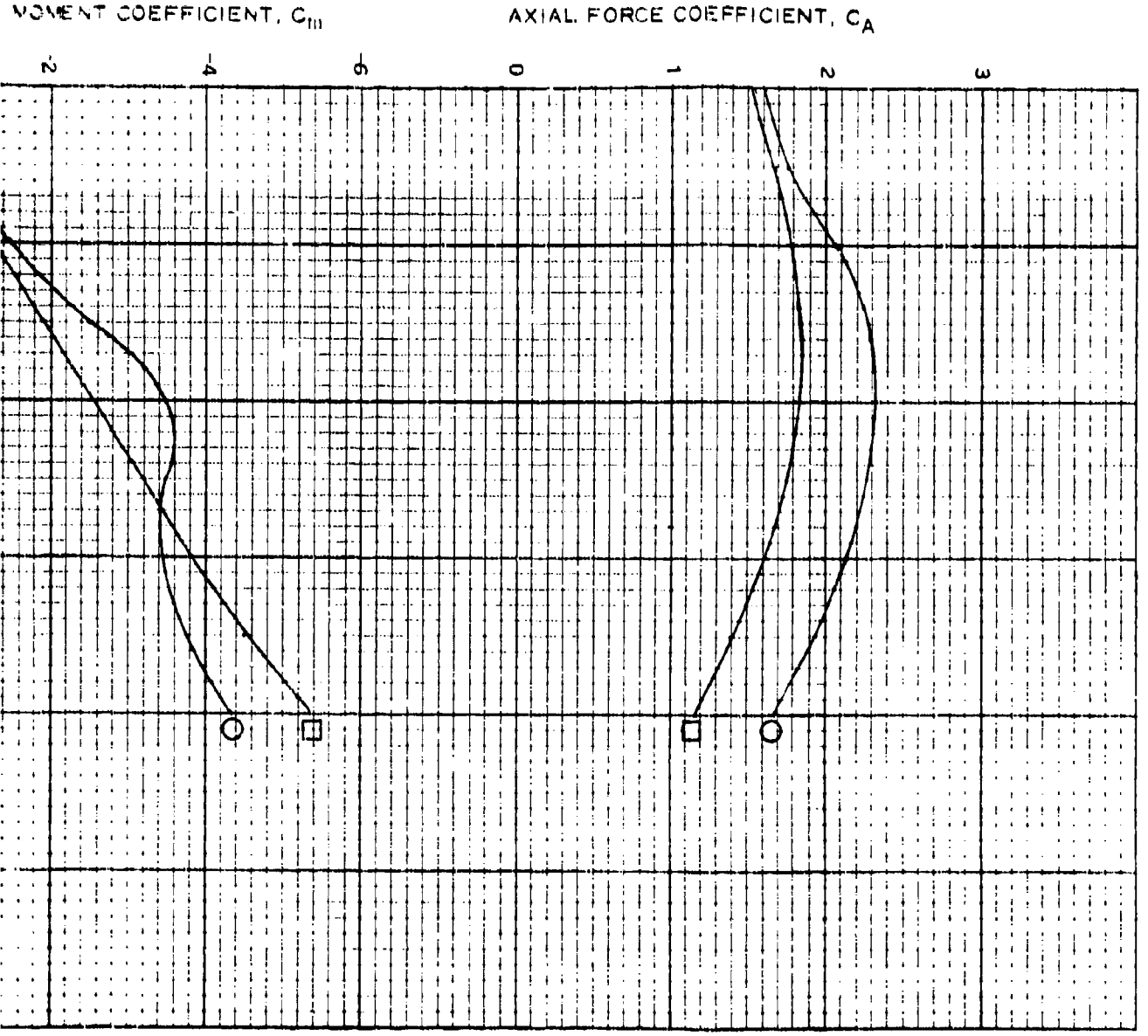

Figure 276. Effect of Burble Fence on the Static Aerodynamics of a 5.0-Caliber Flat-Nosed Bomb with 1.1-Caliber Trip Ring and 2.0-Caliber Ballute Stabilizer

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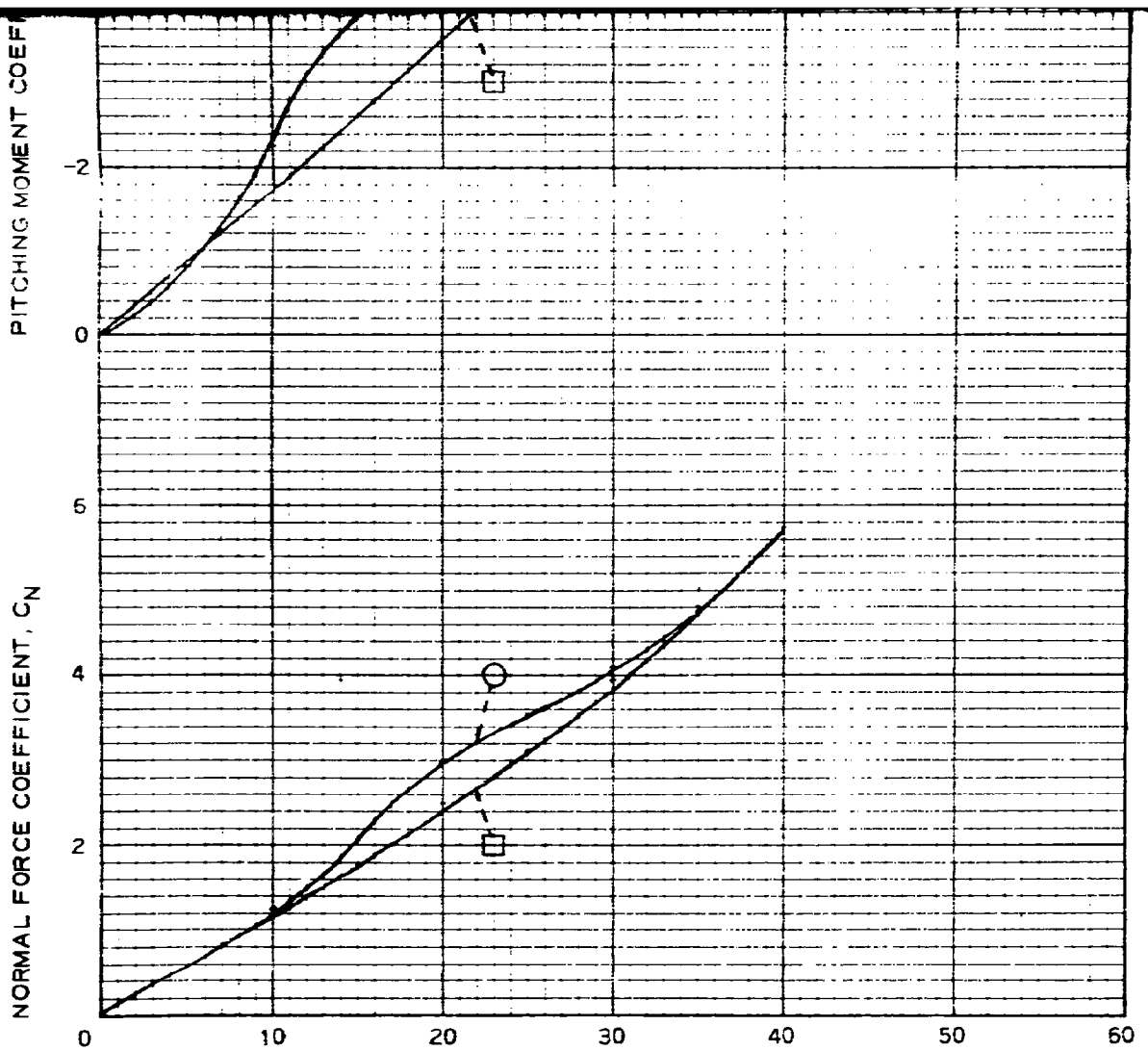

SYM-BOL	CONFIG-URATION	FENCE TYPE
	71	BURBLE
	72	AFT

$$S_{REF} = \frac{\pi D^2}{4}\ \text{CYLINDER}$$

$$\ell_{REF} = D_{CYLINDER}$$

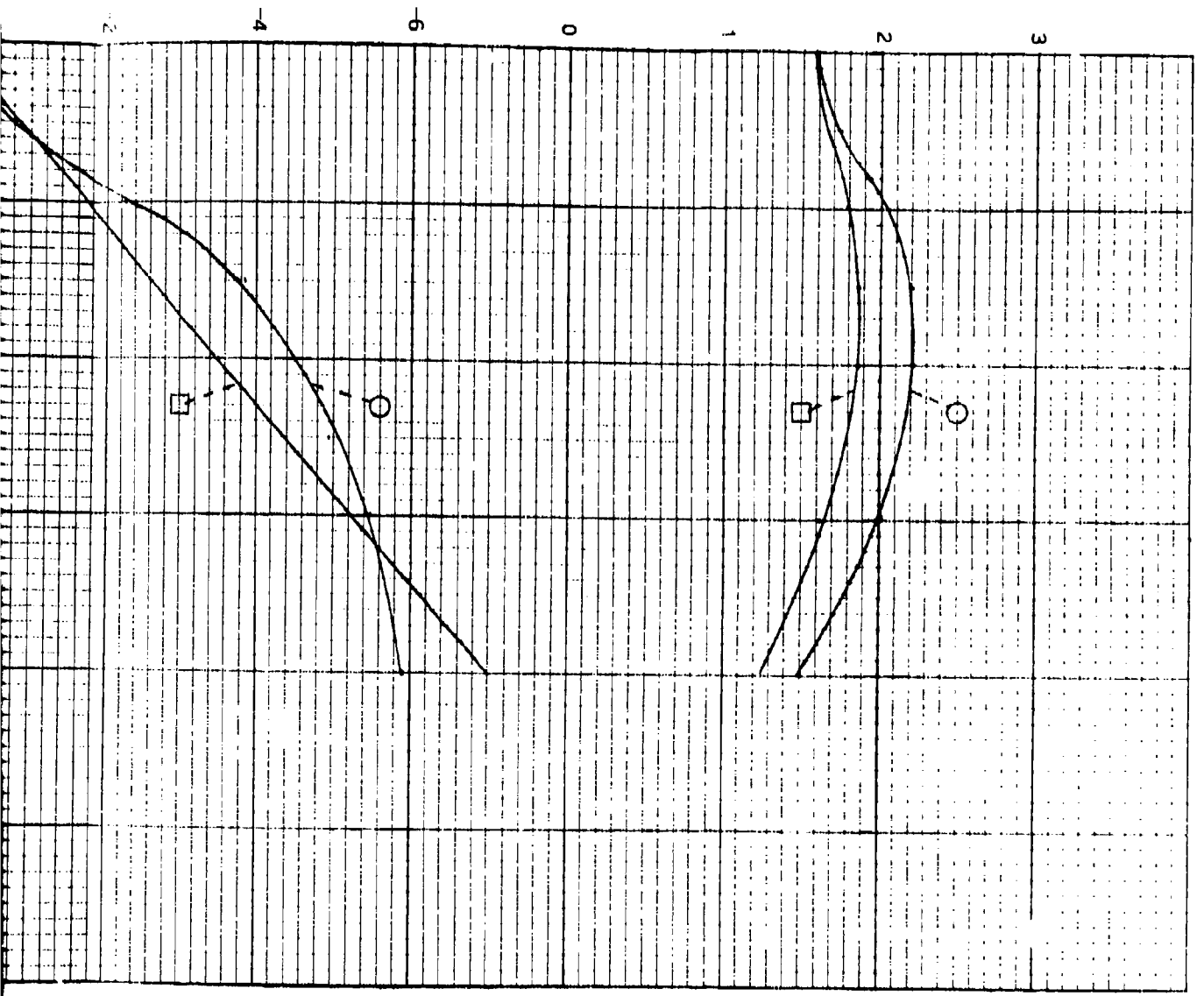

Figure 277. Effect of Burble Fence on the Static Aerodynamics of a 7.0-Caliber Modular Bomb and 2.0-Caliber Ballute

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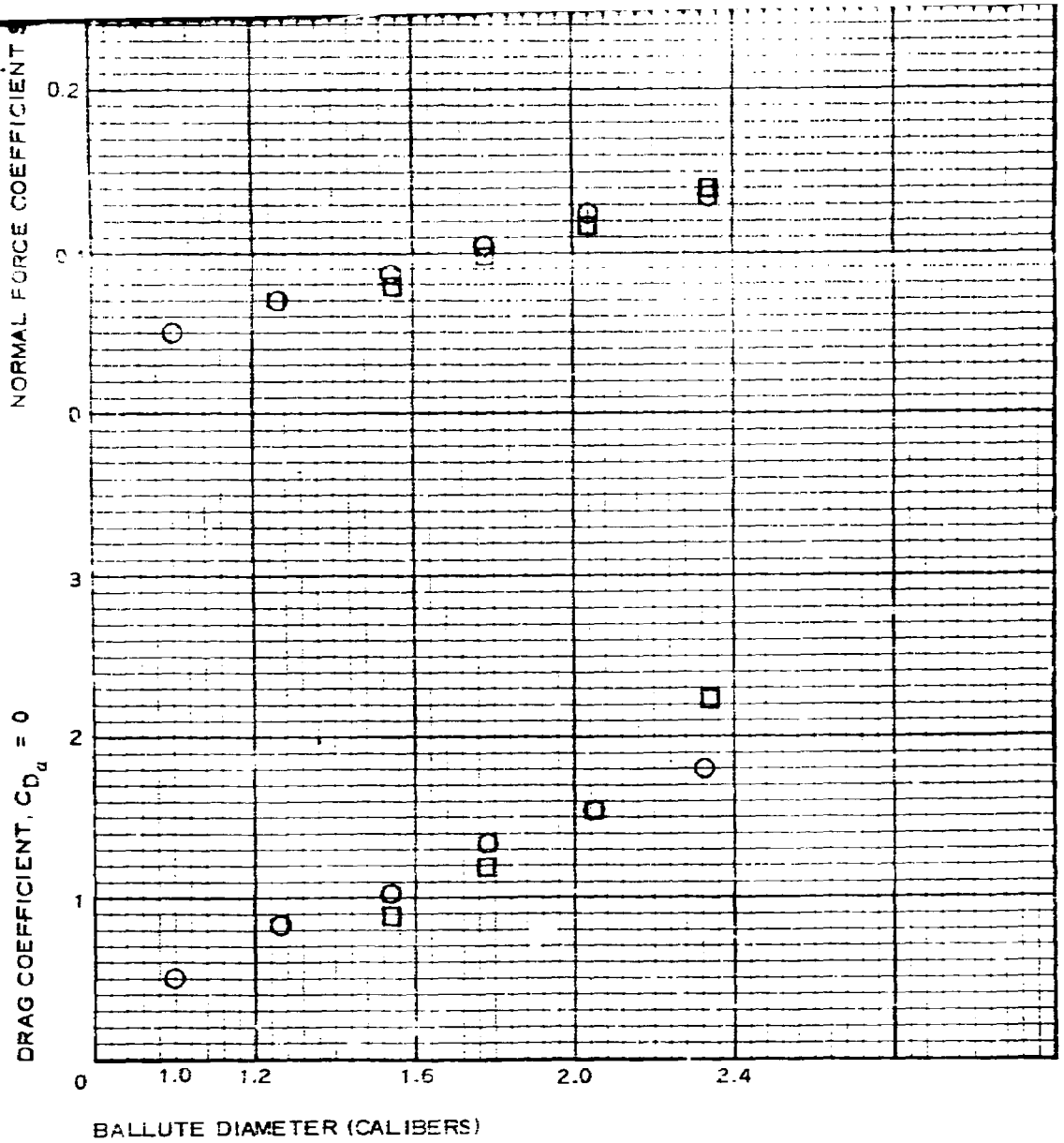

○ WITHOUT FENCE

□ WITH FENCE

* READ DIRECTLY BELOW A CONFIGURATION NUMBER TO OBSERVE DATA FOR THAT CONFIGURATION.

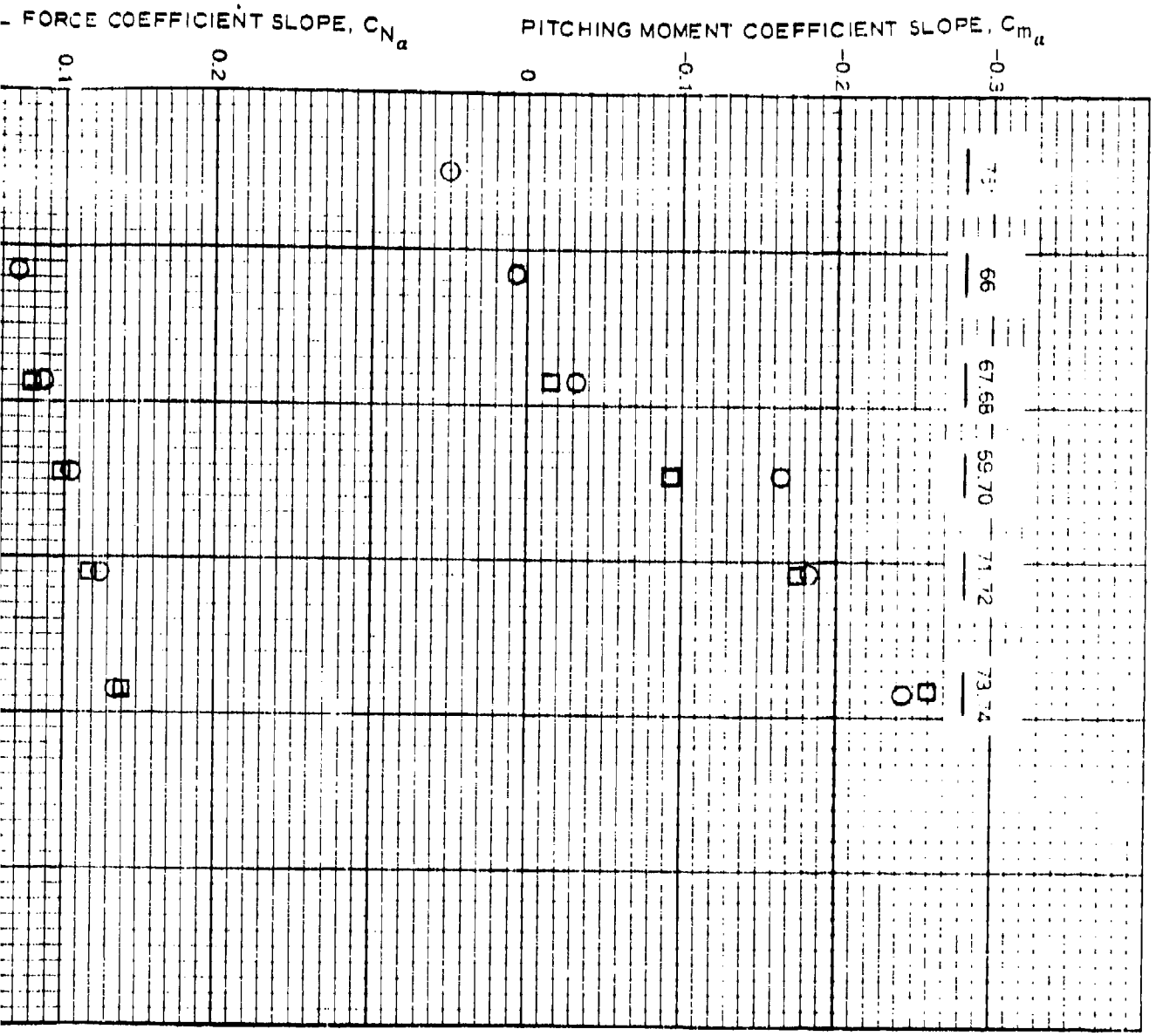

Figure 278. Effect of Burble Fence on Static Aerodynamics of Various Size Ballutes

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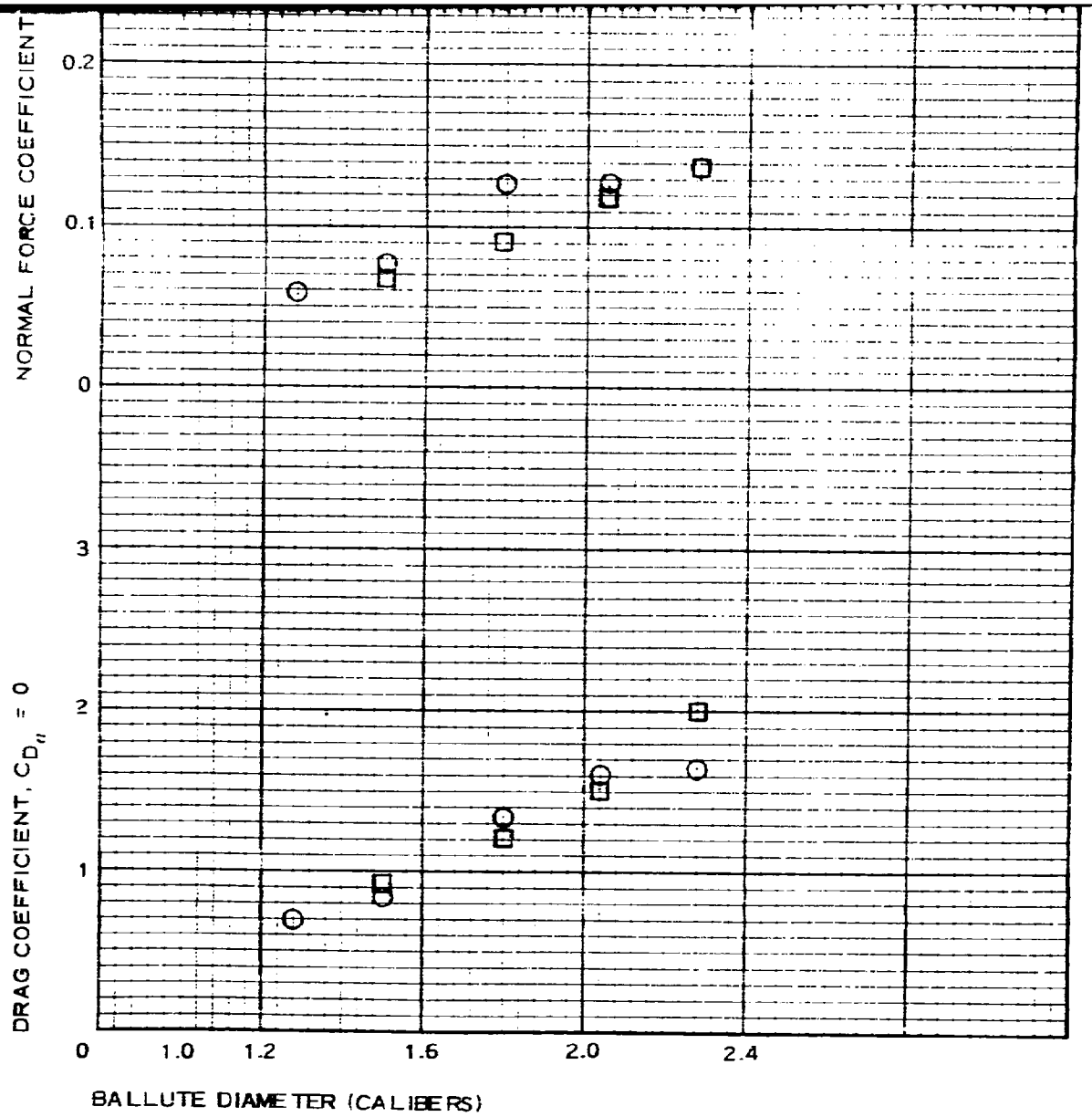

WITHOUT FENCE

WITH FENCE

*READ DIRECTLY BELOW CONFIGURATION NUMBER TO OBSERVE DATA FOR THAT CONFIGURATION.

$$S_{REF} = \frac{\pi D^2}{4}\ \text{CYLINDER}$$

$$\ell_{REF} = D_{CYLINDER}$$

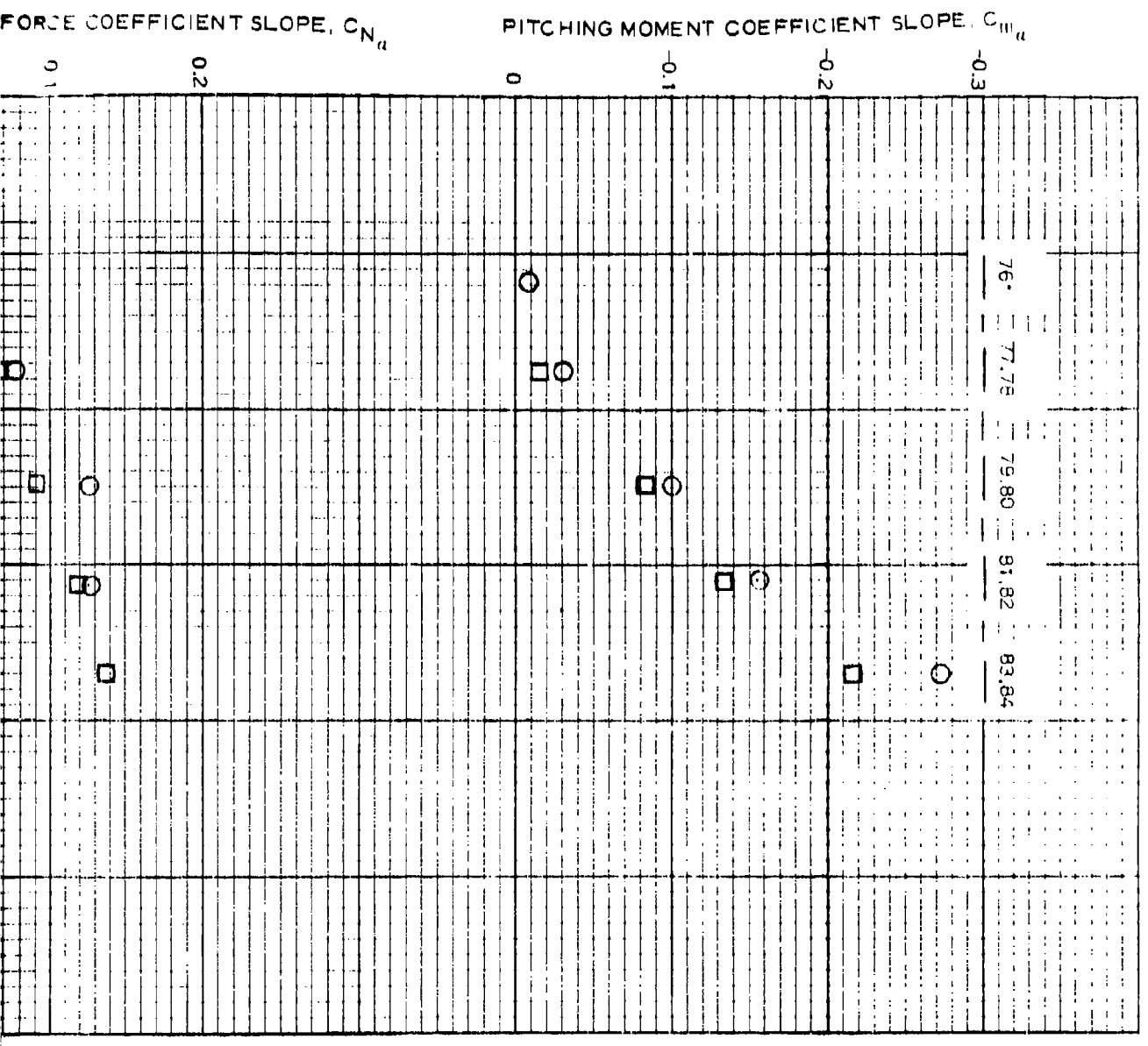

Figure 278. Effect of Burble Fence on Static Aerodynamics of Various Size Ballutes (Continued)

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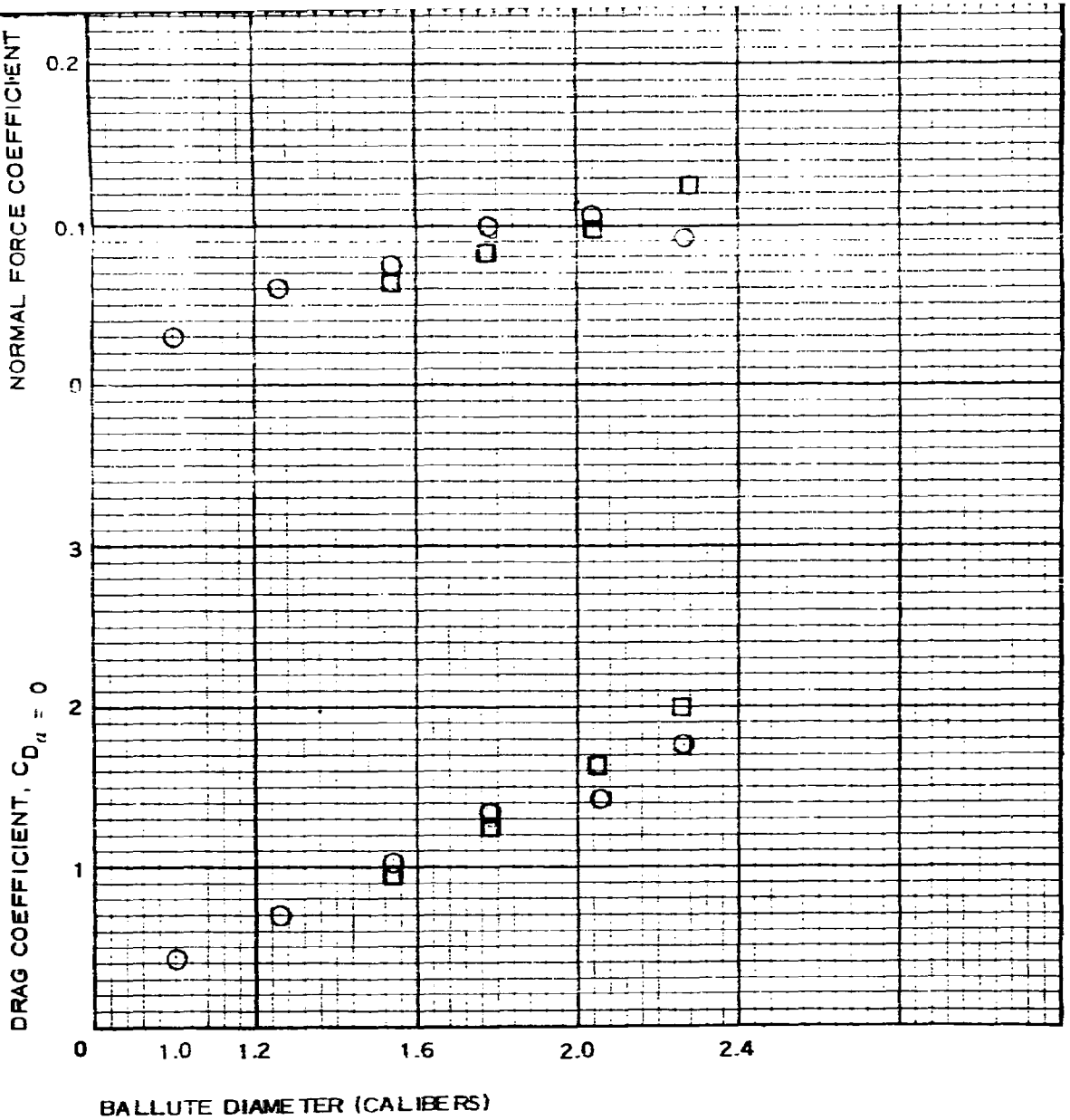

○ WITHOUT FENCE
□ WITH FENCE

* READ DIRECTLY BELOW A CONFIGURATION NUMBER TO OBSERVE DATA FOR THAT CONFIGURATION.

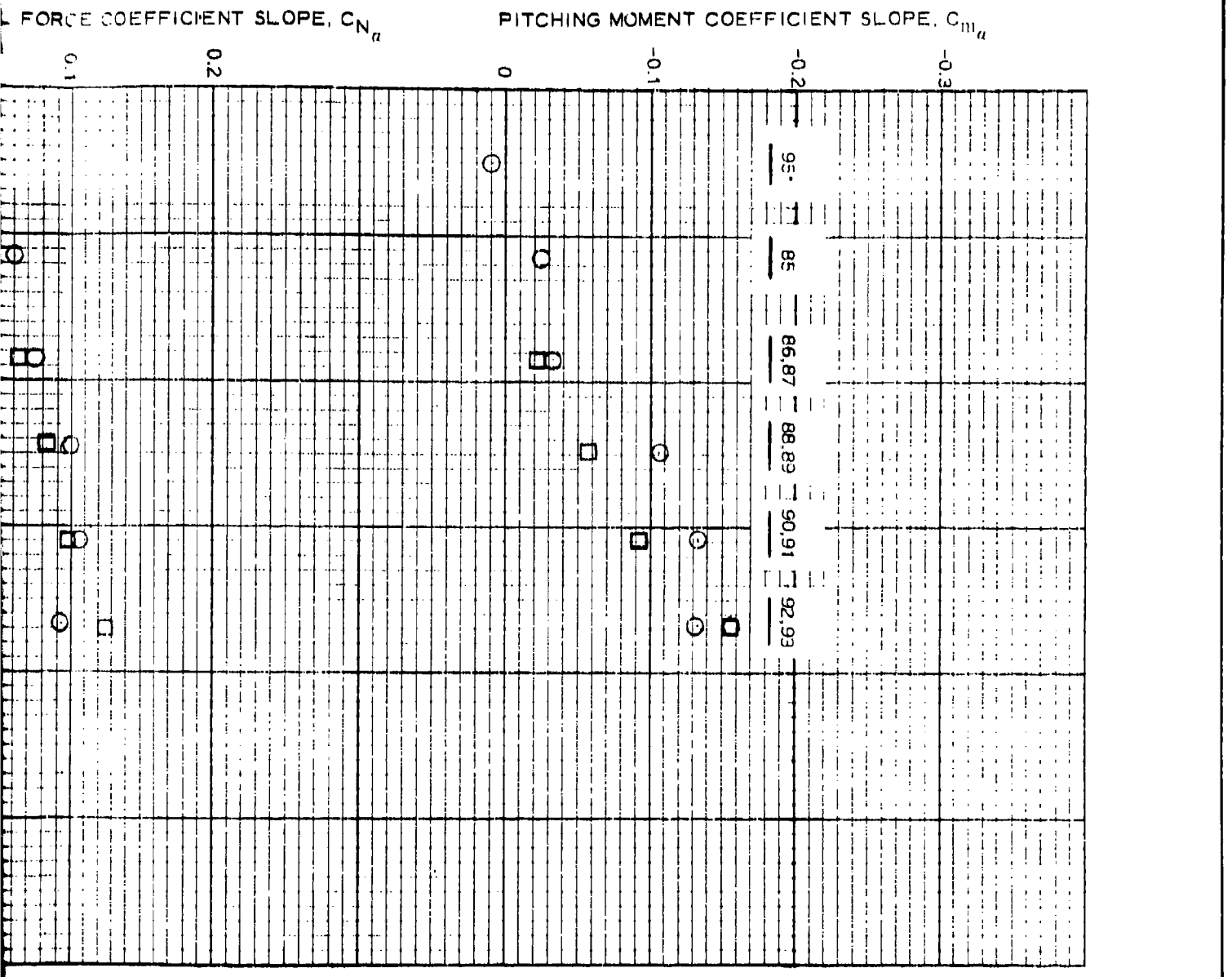

Figure 278. Effect of Burble Fence on Static Aerodynamics of Various Size Ballutes (Concluded)

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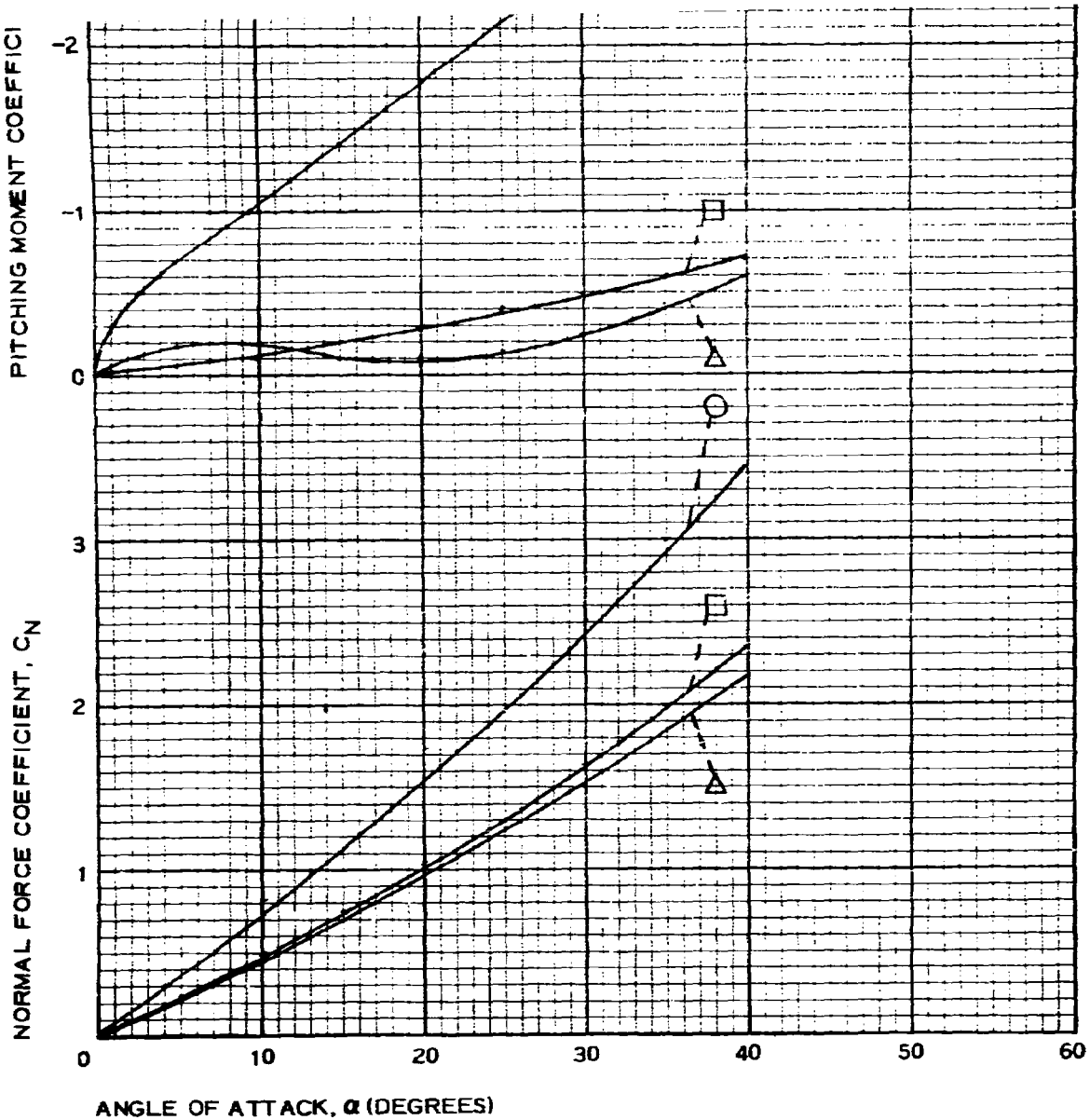

SYMBOL	CONFIGURATION
	39
	38
	37

$S_{REF} = \frac{\pi D^2}{4}$ CYLINDER

$\ell_{REF} = D$ CYLINDER

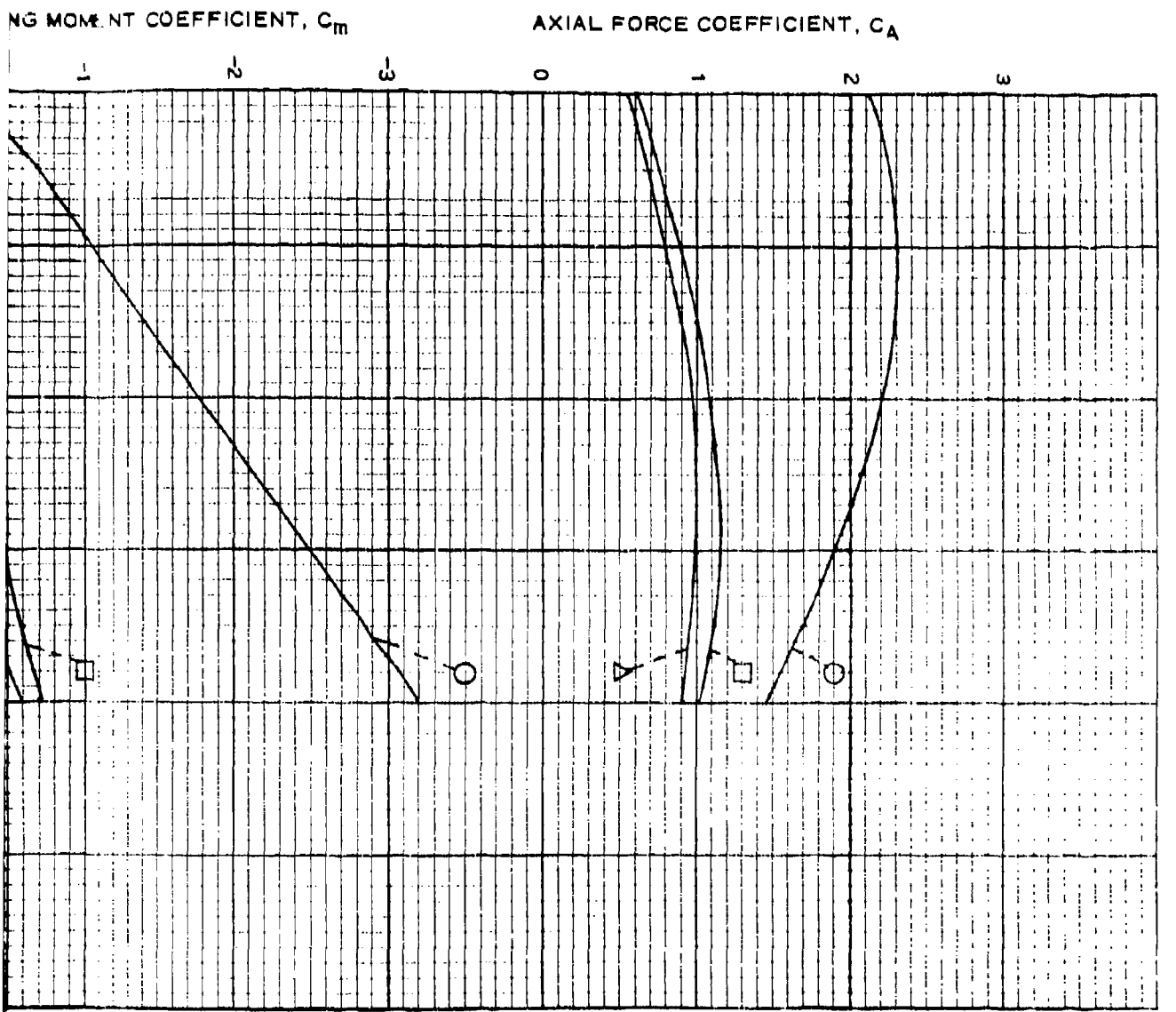

Figure 279. Effect of Small Ballutes on Static Aerodynamics of a Short Blunt Configuration

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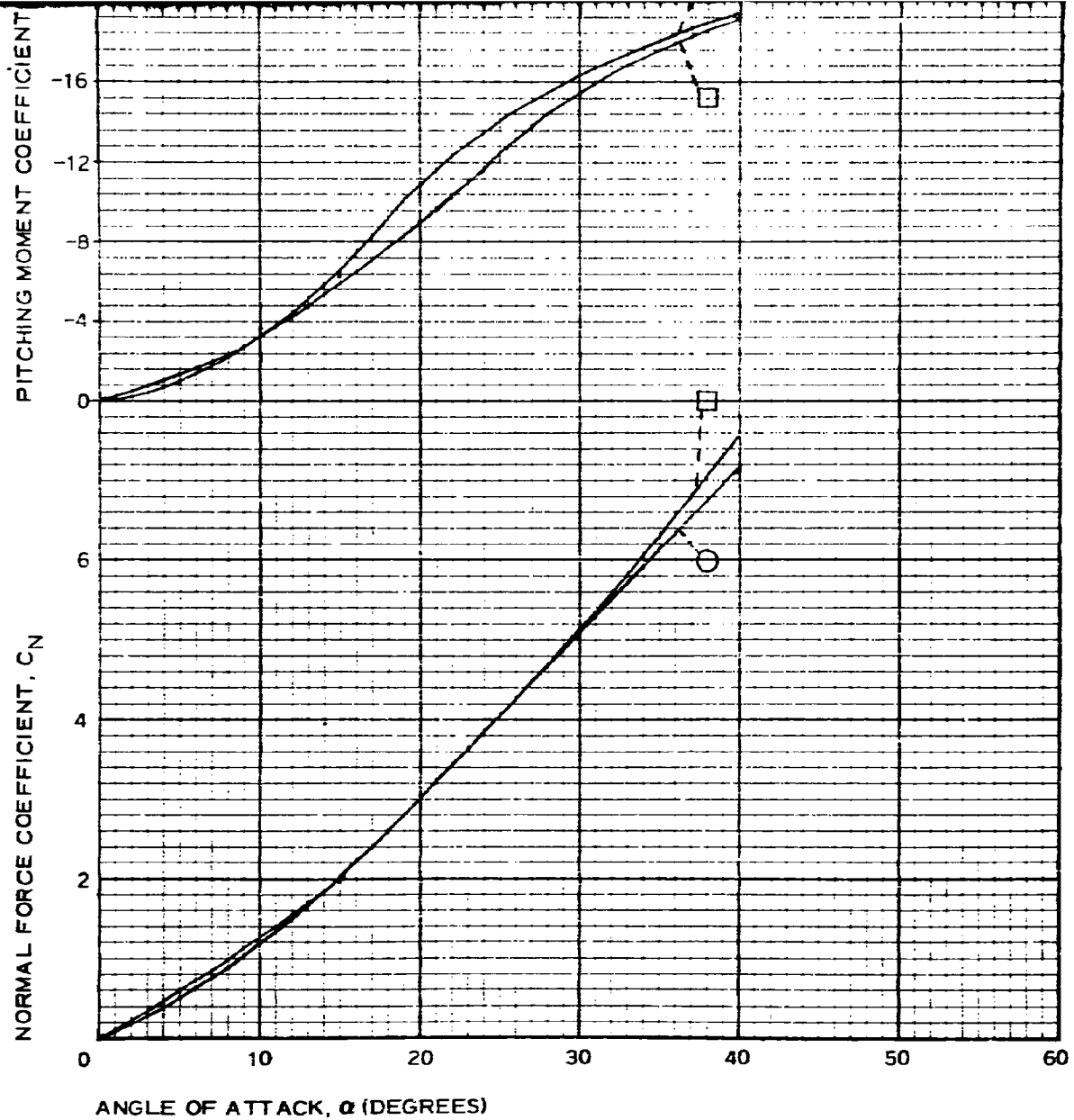

SYMBOL	CONFIGURATION	TRIP RING
	13	1.10 CAL TRIP RING
	10	NO TRIP RING

$$S_{REF} = \frac{\pi D^2}{4}_{CYLINDER}$$

$$\ell_{REF} = D_{CYLINDER}$$

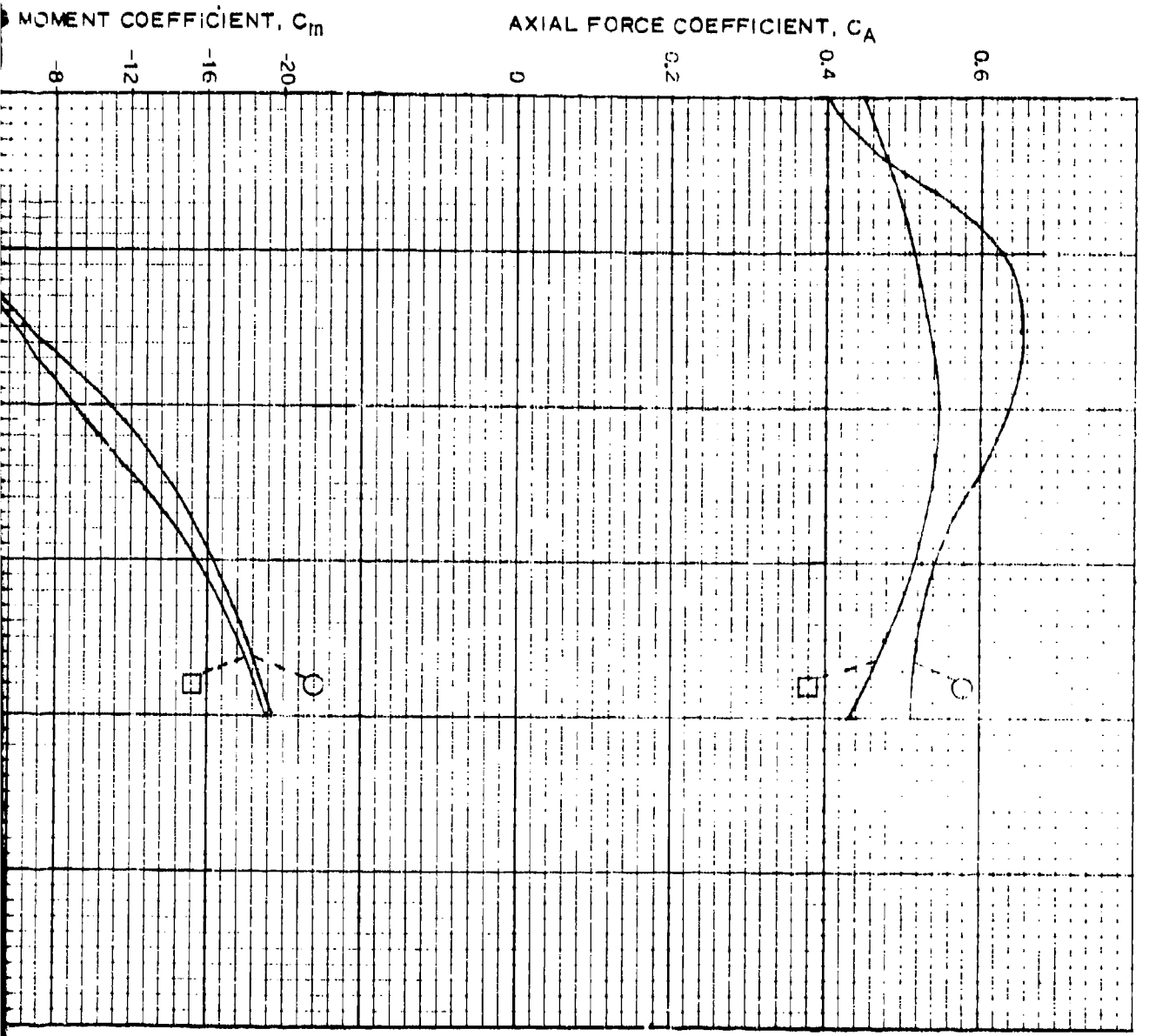

Figure 280. Effect of a Nose Trip Ring on the Static Aerodynamics of a Flat-Nosed 10-Caliber Bomb with Rigid (M118) Fins

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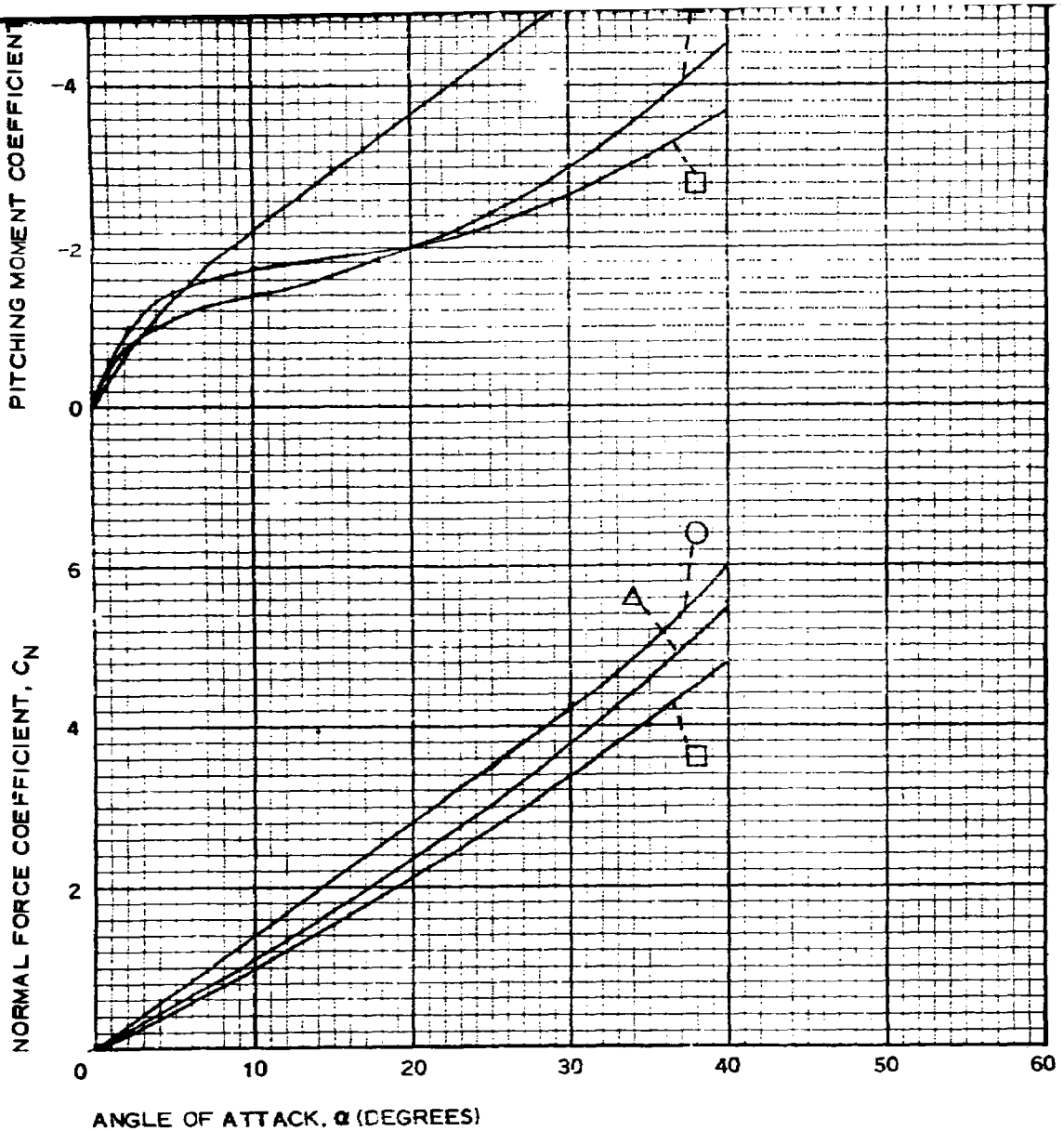

SYMBOL	CONFIGURATION	BURBLE FENCE DIAMETER (CAL)	BURBLE FENCE LOCATION (CAL)
	17	2.27	0.27 AFT OF MAX DIAMETER
	16	2.60	AT MAXIMUM DIAMETER
	15	2.24	AT MAXIMUM DIAMETER

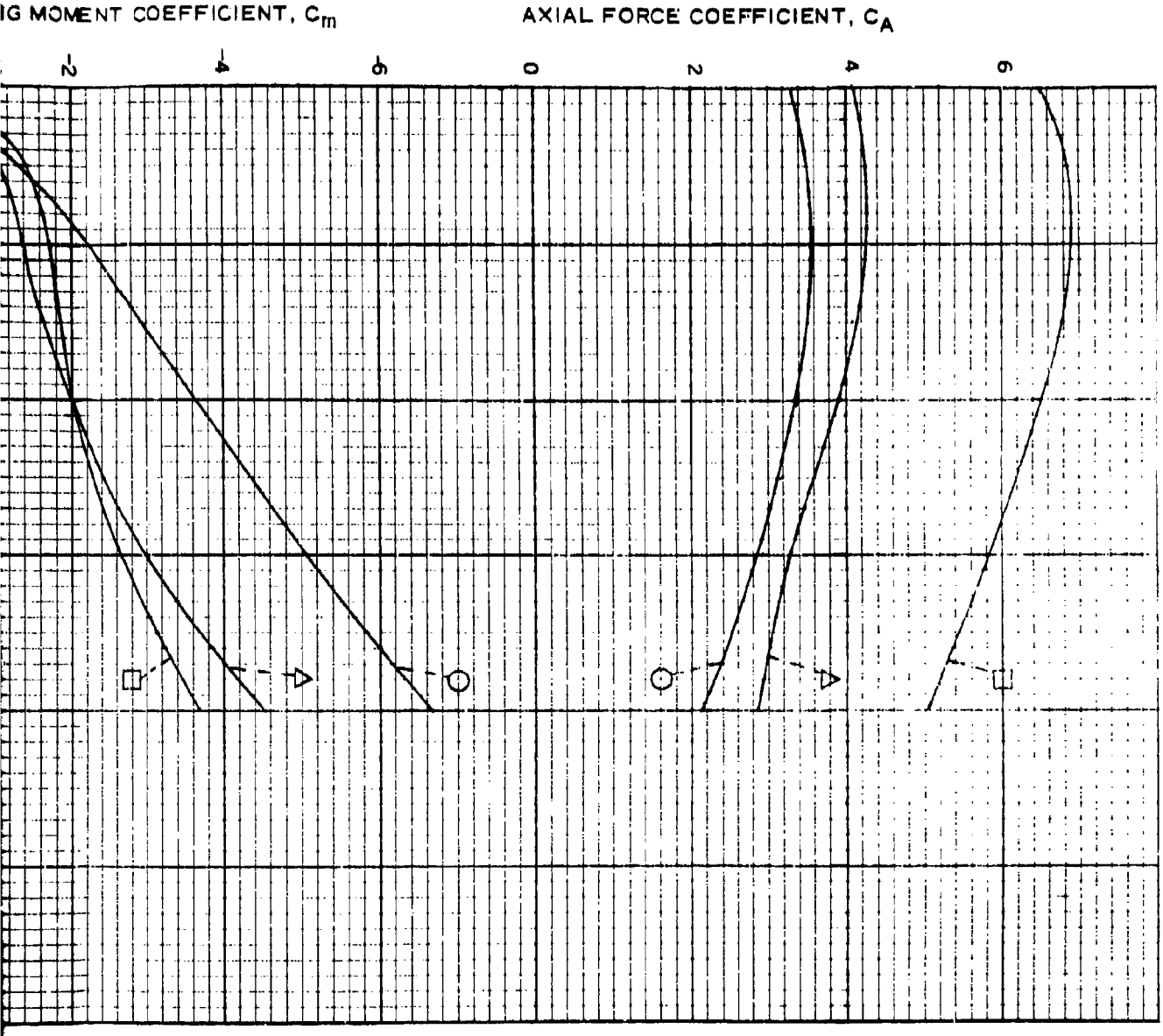

Figure 281. Effect of Burble Fence Size and Location on the Static Aerodynamics of a 5.65-Caliber Flat-Nosed Bomb with 1.1-Caliber Trip Ring and 2.0-Caliber Ballute Stabilizer

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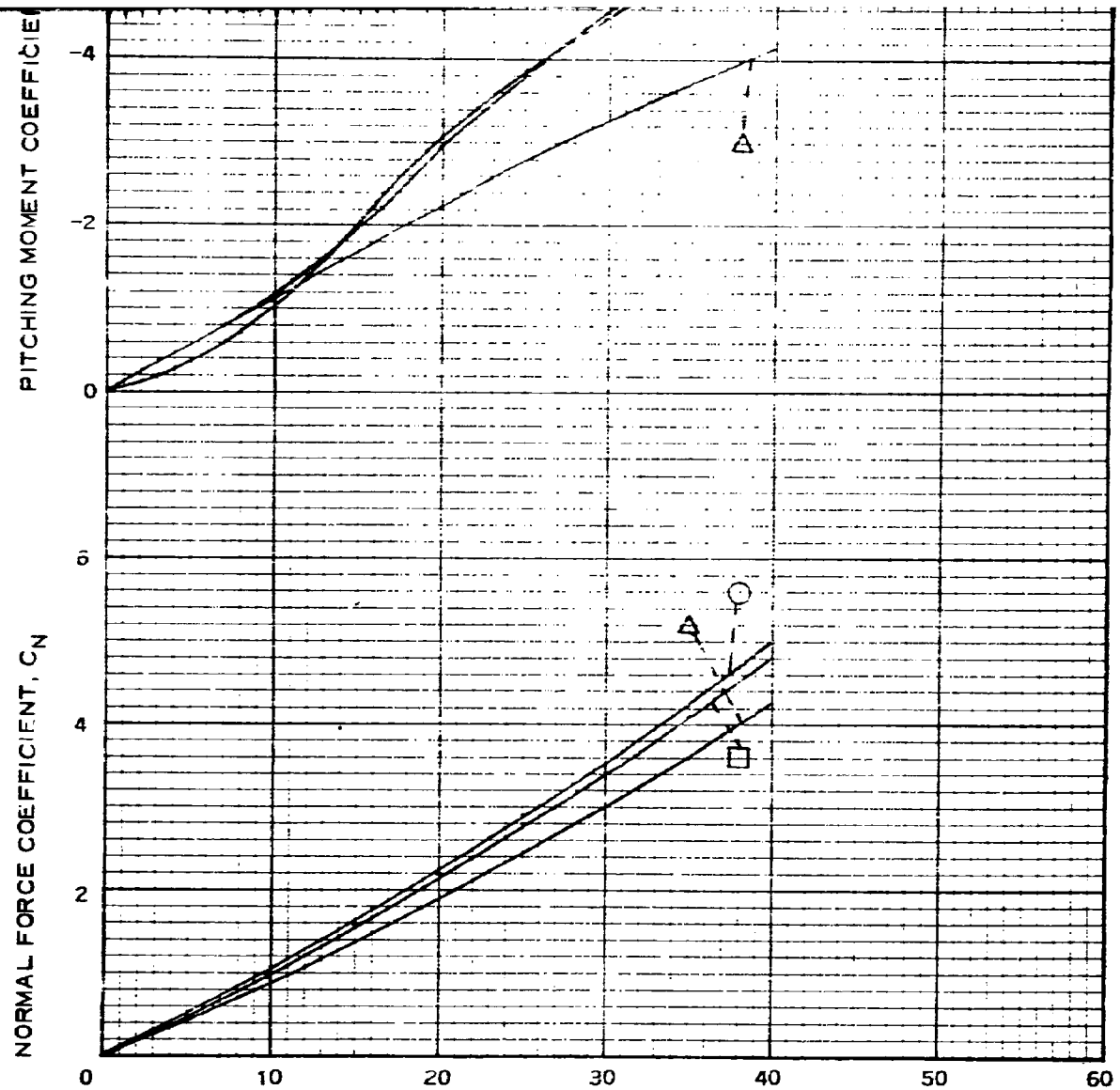

SYMBOL	CONFIGURATION	STRAKES SIZE ON 1-2/3 CAL BOATTAIL
	47	FULL
	46	0.05 CAL HIGH
	45	NONE

$$S_{REF} = \frac{\pi D^2}{4} \text{ CYLINDER}$$

$$\ell_{REF} = D_{CYLINDER}$$

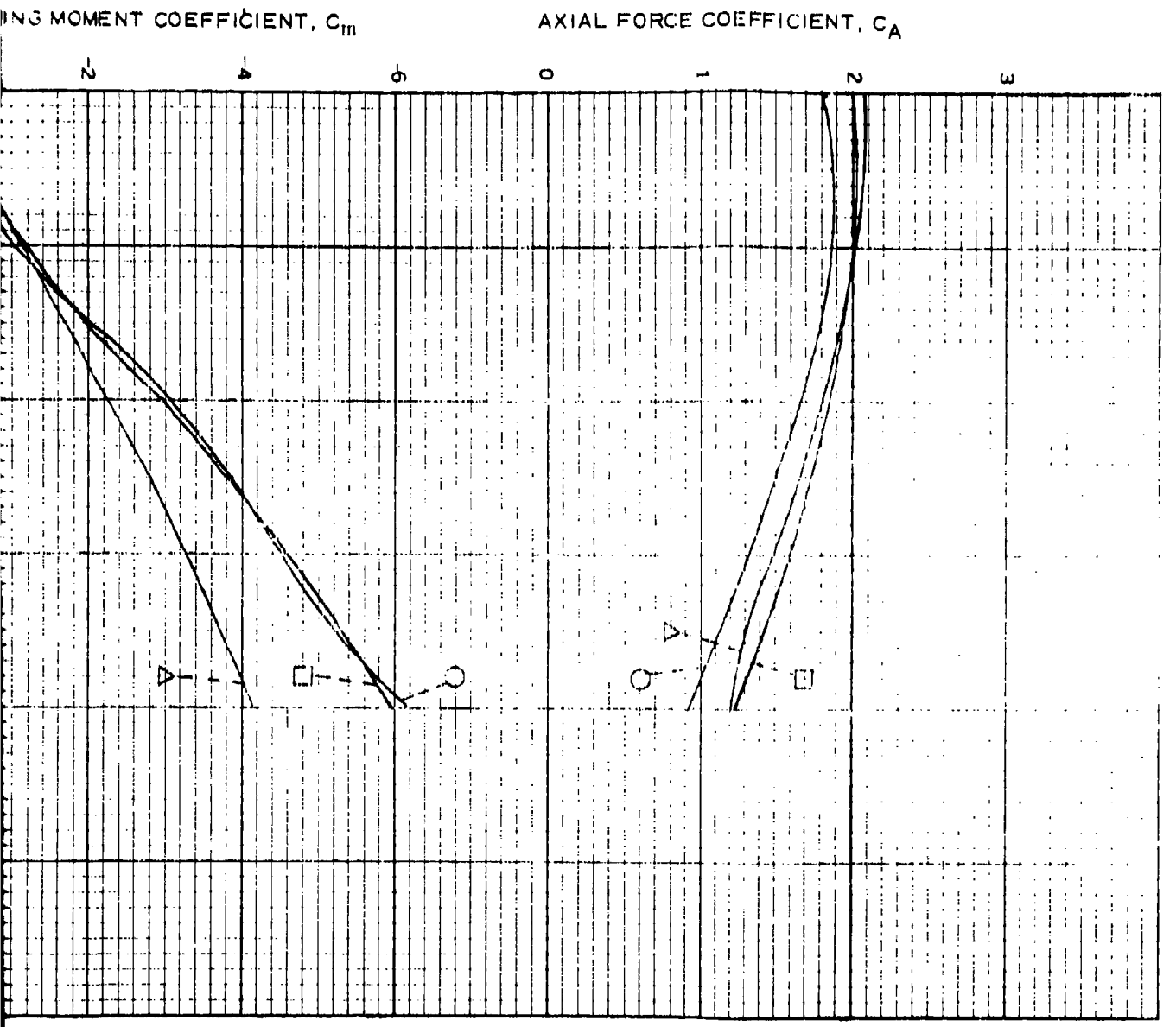

Figure 282. Effect of Strakes at 1-2/3-Caliber Boattail on the Static Aerodynamics of a 2.0-Caliber Ogive-Nosed 7.7-Caliber Bomb and 1-1/2-Caliber Ballute with 1.79-Caliber Fence

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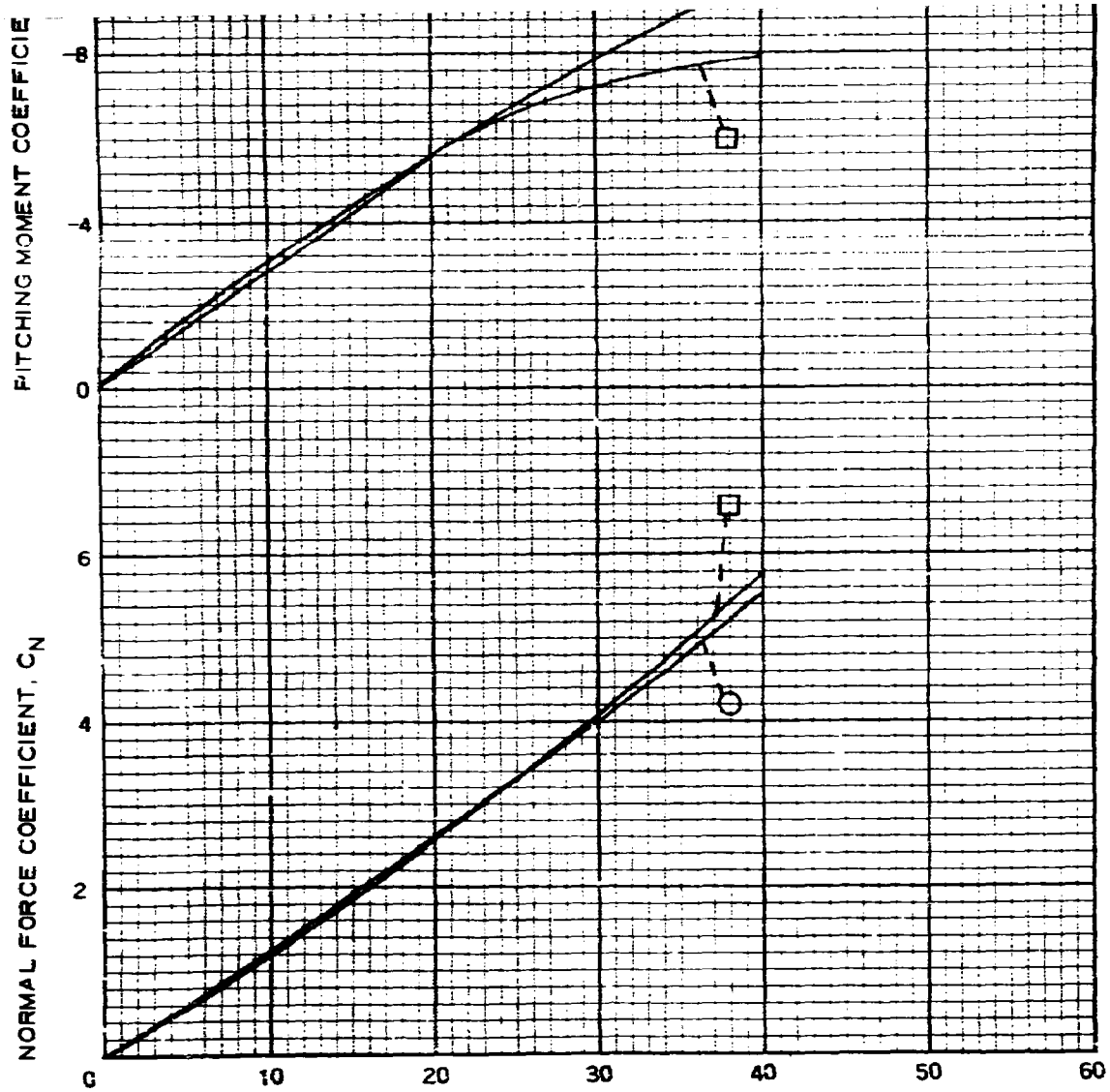

SYM-BOL	CONFIG-URATION	BOATTAIL LENGTH (CAL)	CONE ANGLE (DEG)
	53	1-2/3	10
	51	1	10

$$S_{REF} = \frac{\pi D^2}{4}\ \text{CYLINDER}$$

$$\ell_{REF} = D_{CYLINDER}$$

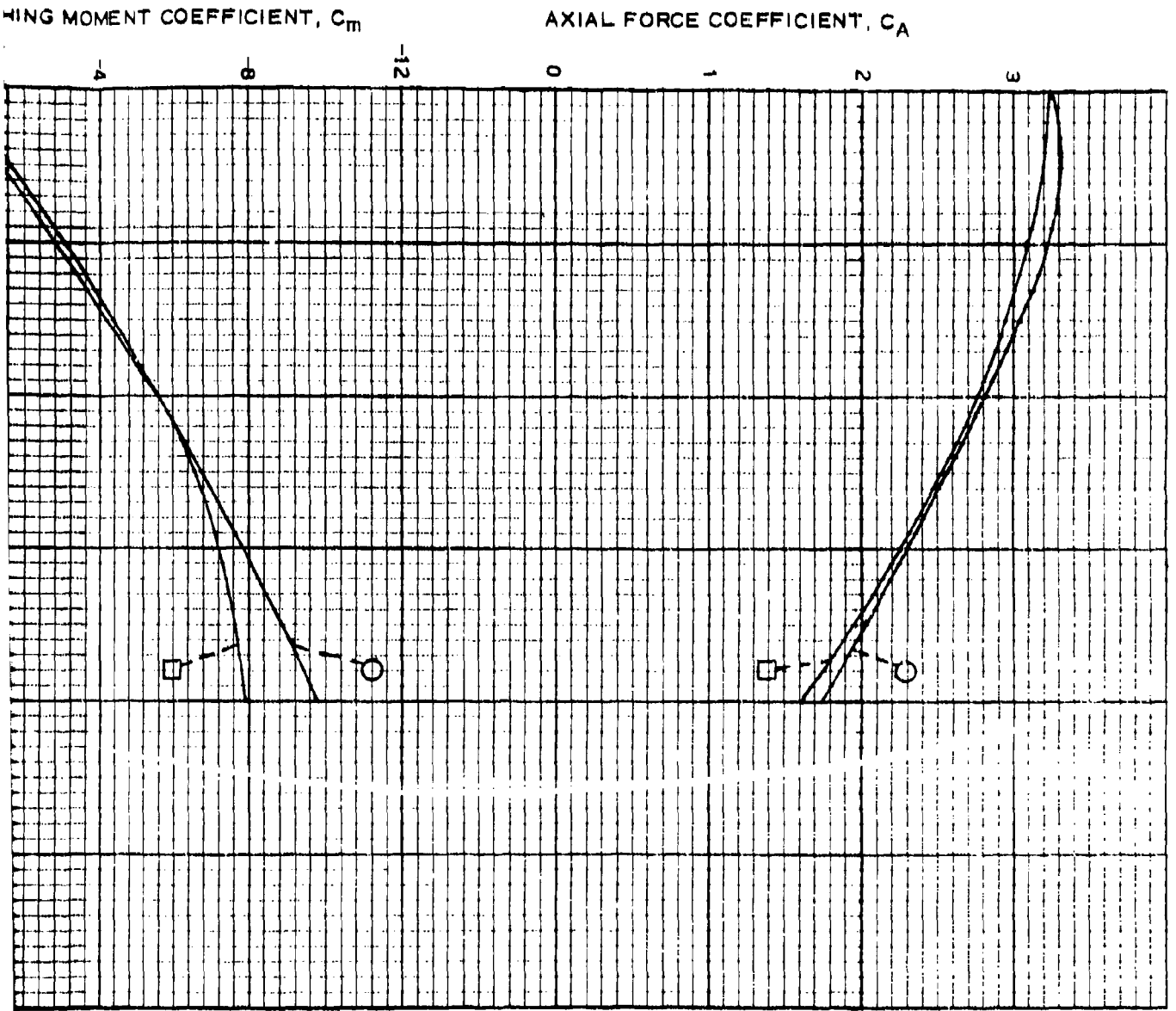

Figure 283. Effect of Boattail Length without Strakes on the Static Aerodynamics of a 2.0-Caliber Ogive-Nosed 7.7-Caliber Bomb and 2.0-Caliber Ballute Stabilizer with 2.27-Caliber Fence

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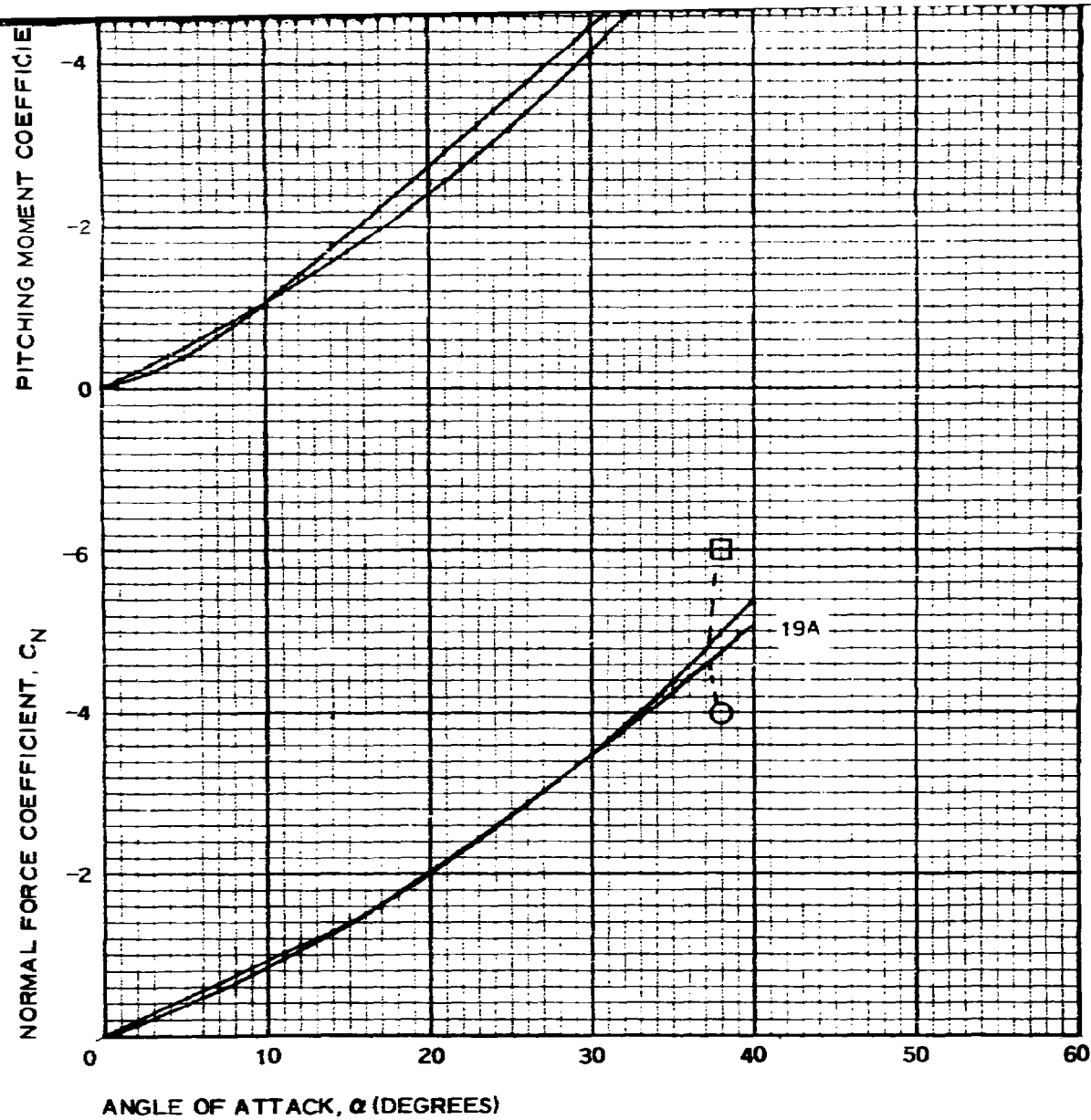

SYM-BOL	CONFIG-URATION	BOATTAIL LENGTH (CAL)	CONE ANGLE (DEG)
○	47	1-2/3	10
□	43	1-1/3	10

$$S_{REF} = \frac{\pi D^2}{4}\ \text{CYLINDER}$$

$$\ell_{REF} = D\ \text{CYLINDER}$$

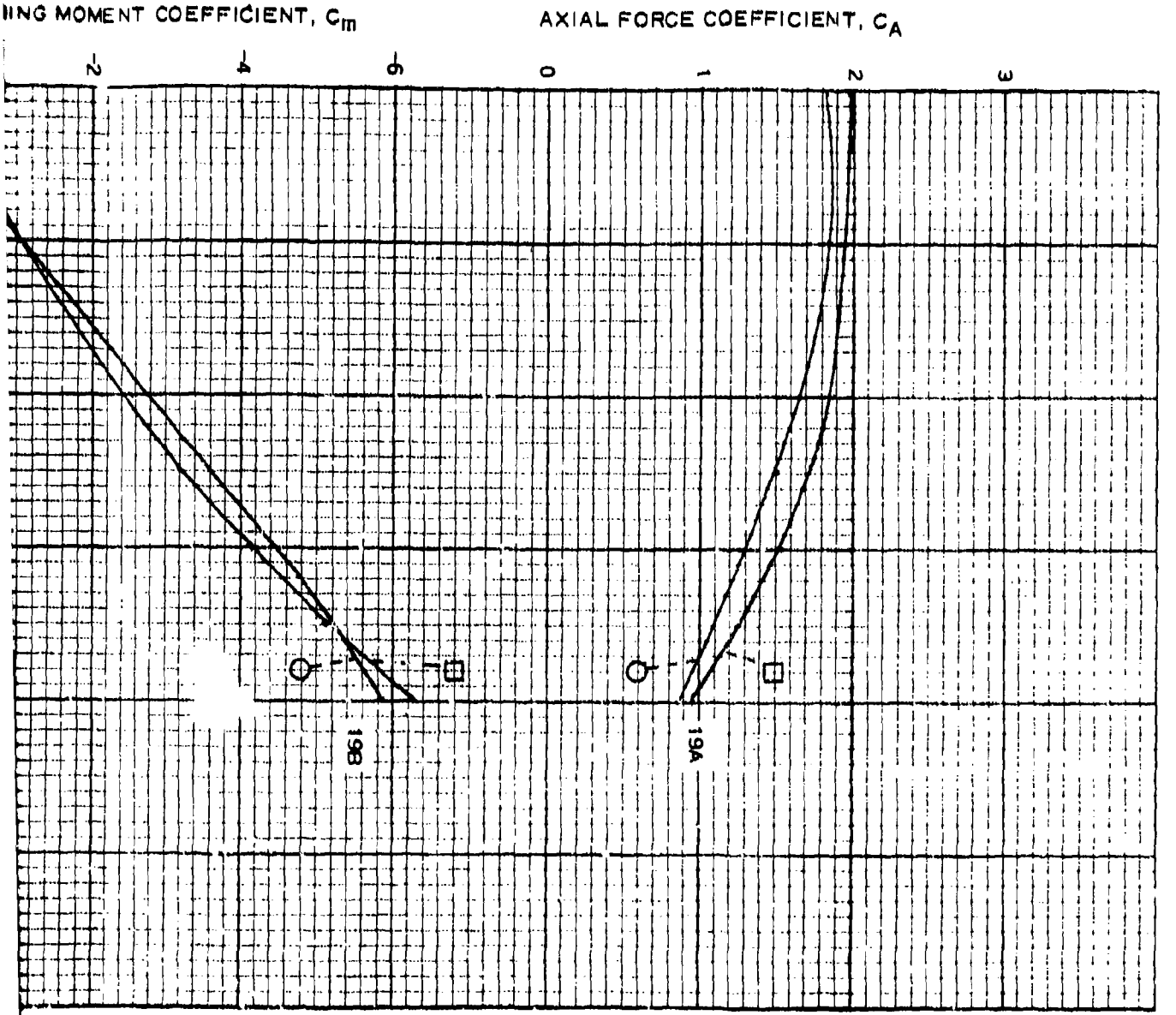

Figure 284. Effect of Boattail Length with Full Strakes on the Static Aerodynamics of a 2.0-Caliber Ogive-Nosed 7.7-Caliber Bomb and 1-1/2-Caliber Ballute Stabilizer with 1.79-Caliber Fence

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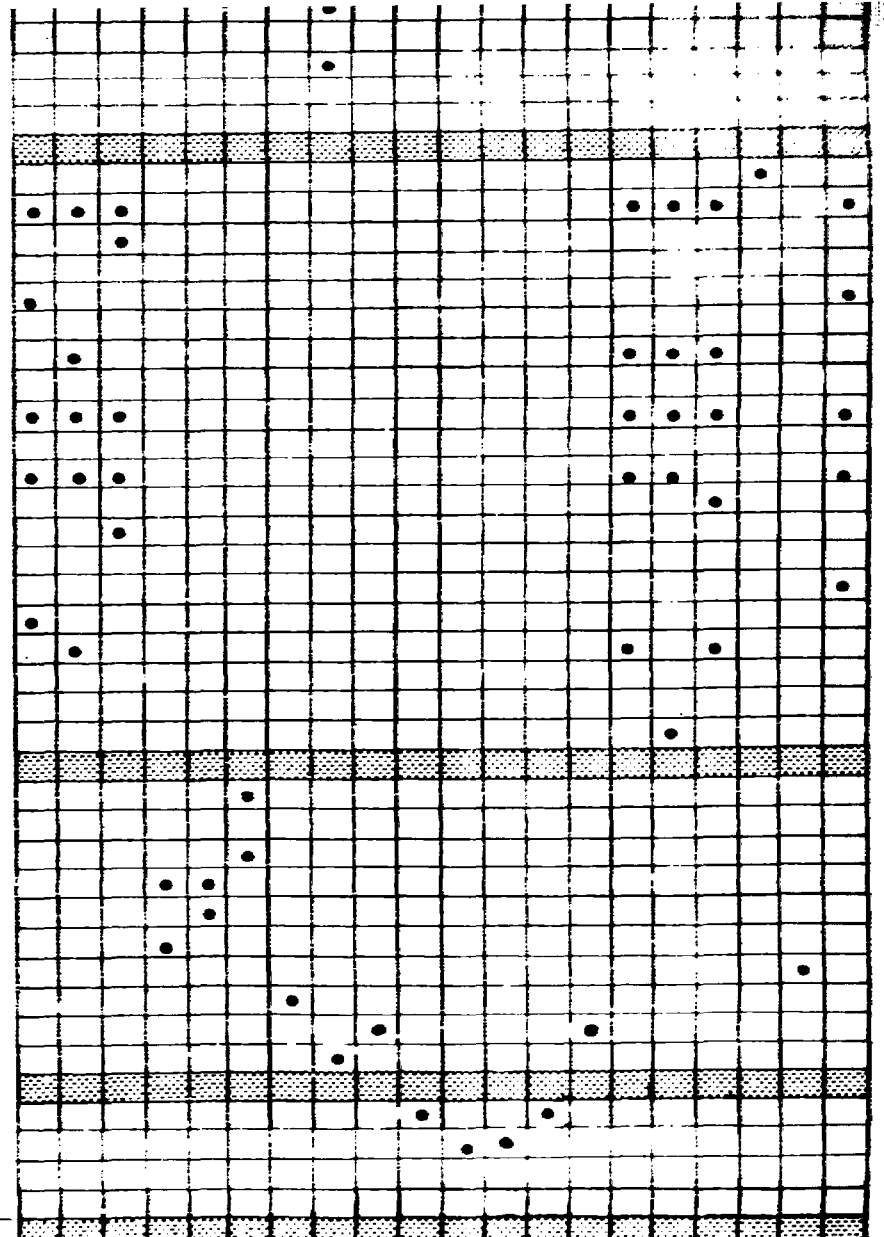
MODEL CHARACTERISTICS	CONFIGURATION NUMBER																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
NOSE GEOMETRY																				
OGIVE																				
1 CALIBER LONG																				
2 CALIBERS LONG																				
3 CALIBERS LONG																				
CONE																				
90 DEG																				
60 DEG																				
30 DEG																				
FLAT WITH 0.1 CALIBER RADIUS	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
PLAIN	●	●	●	●	●	●	●	●	●	●	●							●	●	●
1.1 CALIBER TRIP RING												●	●	●	●	●	●			
HEMISPHERE																				
FINENESS RATIO (EXCLUDING INFLATABLE)																				
1 TO 4																		●	●	●
4 TO 6															●	●	●			
6 TO 8	●	●	●	●	●	●	●	●	●					●						
8 TO 10											●	●								
10 TO 12										●			●							
AFTER SECTION GEOMETRY																				
1 CALIBER CYLINDER									●					●	●	●	●	●	●	●
1.1 CALIBER CYLINDER																				
BOAT TAIL	●	●	●	●	●	●	●	●												
1 CALIBER LONG																				
STRAKES																				
NONE																				
0.05 CALIBER (8)																				
FULL DIAMETER (8)																				
1-1/2 CALIBER LONG	●	●	●	●	●	●	●													
STRAKES	●	●	●	●	●	●														
NONE																				
0.05 CALIBER (8)	●	●	●	●	●	●														
FULL DIAMETER (8)																				
1-2 1/2 CALIBER LONG								●												
STRAKES																				
NONE								●												
0.05 CALIBER (8)																				
FULL DIAMETER (8)																				
STABILIZER																				
NONE																		●		
BALLUTE	●	●	●												●	●	●			●
1 CALIBER DIAMETER			●																	
1-1/4 CALIBER DIAMETER																				
1-1/2 CALIBER DIAMETER																				

STRAKES
NONE
.05 CALIBER 5
FULL DIAMETER 6
STABILIZER
NONE
BALLUTE
1 CALIBER DIAMETER
1-1 4 CALIBER DIAMETER
1-1 2 CALIBER DIAMETER
1-3 4 CALIBER DIAMETER
2 CALIBER DIAMETER
2-1 4 CALIBER DIAMETER
BURBLE FENCE
NONE
AT MAX BALLUTE DIAMETER
SET BACK
1-1 4 CALIBER DIAMETER
1-1 2 CALIBER DIAMETER
1-3 4 CALIBER DIAMETER
2 CALIBER DIAMETER
2-1 4 CALIBER DIAMETER
2-3 8 CALIBER DIAMETER
2-1 2 CALIBER DIAMETER
2-5 8 CALIBER DIAMETER
MISCELLANEOUS INFLATABLE
CONCAVE EXTENSION, 3 4 CAL
PLAIN
4 PANELS
CONCAVE EXTENSION 1 CAL
WITH TORUS NO PANELS
WITH TORUS 4 PANELS
1-1 4 CALIBER DIAMETER TORUS
1-1 2 CAL SPAN CONICAL FINS
1-7 8 CAL SPAN 2-CELL FINS
1-2 3 CALIBER PARATAIL
RIGID FIN
1 5 CAL SPAN FINS (M-118)
1 CAL SPAN FINS (BLU-27 B)



Aerodynamic Data for Configuration Number →	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Configuration Specification pp	20	25	30	31	36	37	38	43	46	51	56	57	58	63	68	73	78	83	86	87
Static Coefficients (digital) pp	21	26		32			39	44	47	52			59	64	69	74	79	84		88
Static Coefficients (graphic) pp	22	27		33			40	45	48	53			60	65	70	75	80	85		89
Dynamic Coefficients (digital) pp	23	28		34			41	46	49	54			61	66	71	76	81			90
Dynamic Coefficients (graphic) pp	24	29		35			42		50	55			62	67	72	77	82			91

Figure 285. Configuration Characteristics Identification Index

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MODEL CHARACTERISTICS	CONFIGURATION NUMBER																		
	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
NOSE GEOMETRY																				
OGIVE																				●
1 CALIBER LONG																				
2 CALIBERS LONG																				
3 CALIBERS LONG																				●
CONE																				
90 DEG																				
60 DEG																				
30 DEG																				
FLAT WITH 0.1 CALIBER RADIUS	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
PLAIN	●	●	●	●	●	●	●	●												
1.1 CALIBER TRIP RING									●	●	●	●	●	●	●	●	●	●	●	
HEMISPHERE																				
FINENESS RATIO (EXCLUDING INFLATABLE)																				
1 TO 4	●	●	●	●		●	●	●									●	●	●	
4 TO 6					●								●	●	●	●				
6 TO 8																				
8 TO 10									●	●	●	●								
10 TO 12																				●
AFTER SECTION GEOMETRY																				
1 CALIBER CYLINDER	●	●	●																	
1.1 CALIBER CYLINDER									●	●	●	●	●	●	●	●	●	●	●	
BOAT TAIL				●	●	●	●	●												●
1 CALIBER LONG						●	●	●												
STRAKES						●	●	●												
NONE																				
0.05 CALIBER (8)						●	●	●												
FULL DIAMETER (8)																				
1-1/3 CALIBER LONG				●																●
STRAKES																				●
NONE				●																
0.05 CALIBER (8)																				●
FULL DIAMETER (8)																				
1-2.3 CALIBER LONG					●															
STRAKES																				
NONE					●															
0.05 CALIBER (8)																				
FULL DIAMETER (8)																				
STABILIZER																				
NONE									●		●		●		●		●			
BALLUTE	●	●						●		●		●		●		●			●	●
1 CALIBER DIAMETER								●												●
1-1.4 CALIBER DIAMETER																				
1-1/2 CALIBER DIAMETER																				

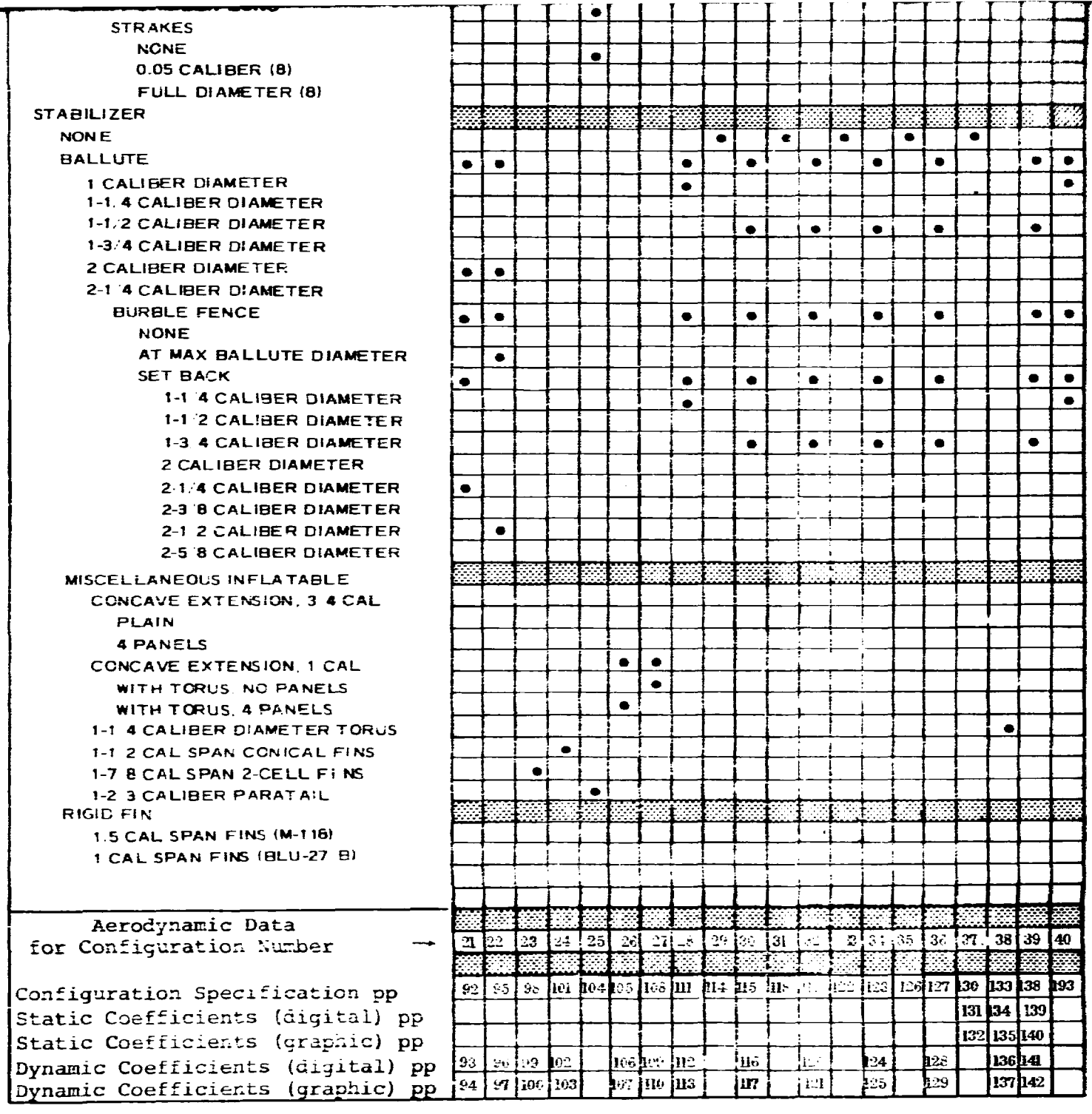

Figure 285. Configuration Characteristics Identification Index (Continued)

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MODEL CHARACTERISTICS	CONFIGURATION NUMBER																			
	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
NOSE GEOMETRY																				
OGIVE	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
1 CALIBER LONG																				
2 CALIBERS LONG		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
3 CALIBERS LONG	●																			
CONE																				
90 DEG																				
60 DEG																				
30 DEG																				
FLAT WITH 0.1 CALIBER RADIUS																				
PLAIN																				
1.1 CALIBER TRIP RING																				
HEMISPHERE																				
FINENESS RATIO (EXCLUDING INFLATABLE)																				
1 TO 4																				
4 TO 6																				
6 TO 8		●	●	●	●	●	●	●	●	●	●	●	●	●	●			●	●	●
8 TO 10																●	●			
10 TO 12	●																			
AFTER SECTION GEOMETRY																				
1 CALIBER CYLINDER														●	●	●	●			
1.1 CALIBER CYLINDER																				
BOAT TAIL	●	●	●	●	●	●	●	●	●	●	●	●	●					●	●	●
1 CALIBER LONG								●	●	●	●									
STRAKES								●												
NONE									●	●	●									
0.05 CALIBER (8)																				
FULL DIAMETER (8)								●												
1-1 3 CALIBER LONG	●	●	●	●								●						●	●	●
STRAKES	●	●	●																●	
NONE				●								●						●		●
0.05 CALIBER (8)	●	●																	●	
FULL DIAMETER (8)			●																	
1-2 3 CALIBER LONG					●	●	●						●							
STRAKES						●	●													
NONE					●								●							
0.05 CALIBER (8)						●														
FULL DIAMETER (8)							●													
STABILIZER																				
NONE																				
BALLUTE	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●					
1 CALIBER DIAMETER										●										
1-1 4 CALIBER DIAMETER																				
1-1 2 CALIBER DIAMETER	●	●	●	●	●	●	●	●	●						●					
1-3 4 CALIBER DIAMETER																				

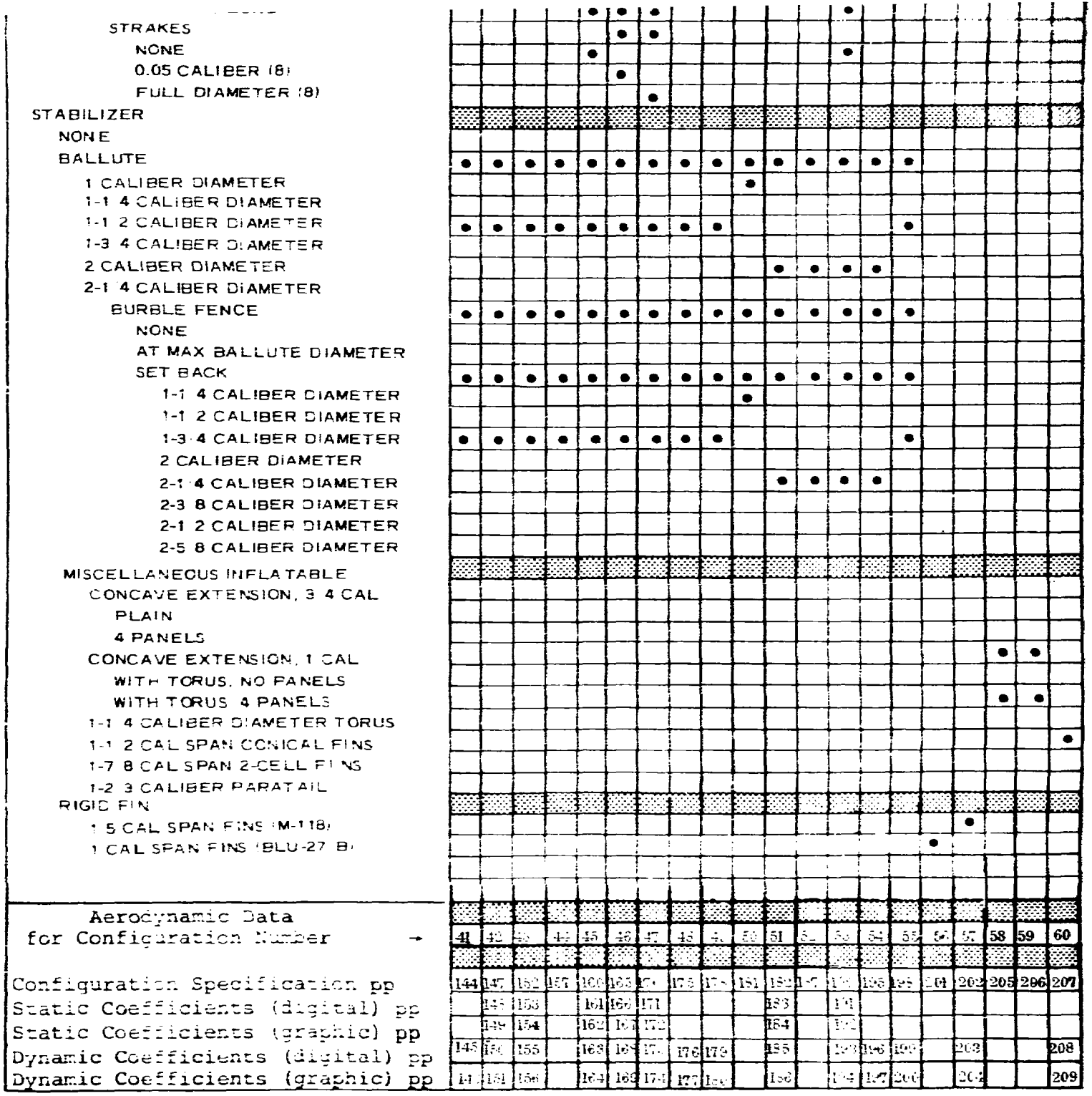

Figure 285. Configuration Characteristics Identification Index (Continued)

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MODEL CHARACTERISTICS	CONFIGURATION NUMBER																		
	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
NOSE GEOMETRY																				
OGIVE	•	•																		
1 CALIBER LONG																				
2 CALIBERS LONG	•	•																		
3 CALIBERS LONG																				
CONE																				
90 DEG																				
60 DEG																				
30 DEG																				
FLAT WITH 0.1 CALIBER RADIUS			•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
PLAIN				•																
1.1 CALIBER TRIP RING			•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
HEMISPHERE																				
FINENESS RATIO (EXCLUDING INFLATABLE)																				
1 TO 4			•																	
4 TO 6					•											•	•	•	•	•
6 TO 8	•	•		•		•	•	•	•	•	•	•	•	•	•					
8 TO 10																				
10 TO 12																				
AFTER SECTION GEOMETRY																				
1 CALIBER CYLINDER	•				•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
1.1 CALIBER CYLINDER			•																	
BOAT TAIL		•		•																
1 CALIBER LONG																				
STRAKES																				
NONE																				
0.05 CALIBER (8)																				
FULL DIAMETER (8)																				
1-1/3 CALIBER LONG		•		•																
STRAKES		•		•																
NONE																				
0.05 CALIBER (8)		•		•																
FULL DIAMETER (8)																				
1-2 3 CALIBER LONG																				
STRAKES																				
NONE																				
0.05 CALIBER (8)																				
FULL DIAMETER (8)																				
STABILIZER																				
NONE		•	•	•	•										•					
BALLUTE						•	•	•	•	•	•	•	•	•		•	•	•	•	•
1 CALIBER DIAMETER																				
1-1/4 CALIBER DIAMETER						•										•				
1-1 2 CALIBER DIAMETER							•	•									•	•		

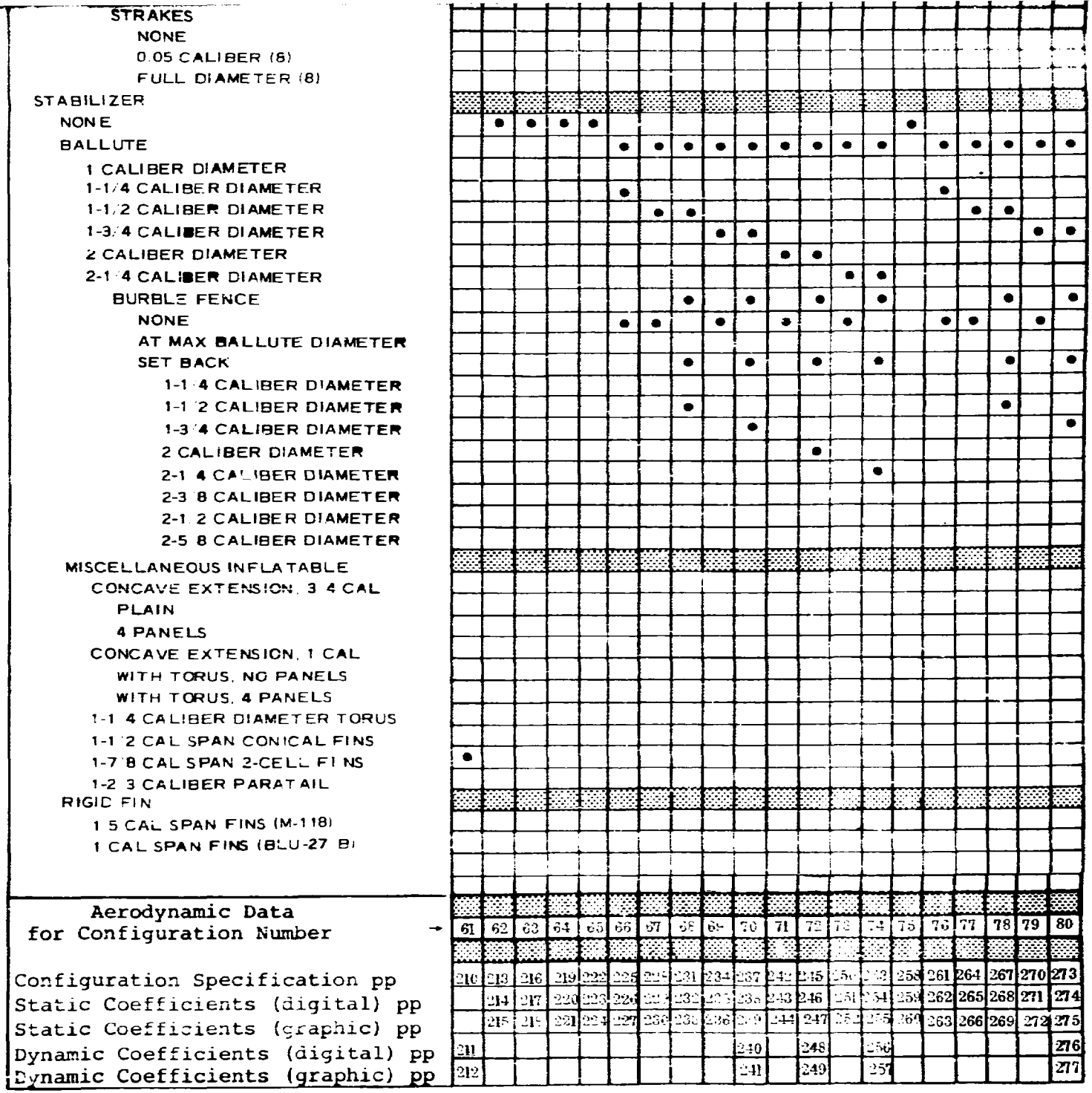

Figure 285 Configuration Characteristics Identification Index (Continued)

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MODEL CHARACTERISTICS	CONFIGURATION NUMBER																			
	81	82	83	84	84 A	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99
NOSE GEOMETRY																				
OGIVE																	●	●	●	●
1 CALIBER LONG																	●	●	●	●
2 CALIBERS LONG																				
3 CALIBERS LONG																				
CONE																				
90 DEG																				
60 DEG																				
30 DEG																				
FLAT WITH 0.1 CALIBER RADIUS	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●				
PLAIN																				
1.1 CALIBER TRIP RING	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●				
HEMISPHERE																				
FINENESS RATIO (EXCLUDING INFLATABLE)																				
1 TO 4						●	●	●	●	●	●	●	●	●		●	●	●	●	●
4 TO 6	●	●	●	●	●										●					
6 TO 8																				
8 TO 10																				
10 TO 12																				
AFTER SECTION GEOMETRY																				
1 CALIBER CYLINDER	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
1.1 CALIBER CYLINDER																				
BOAT TAIL																				
1 CALIBER LONG																				
STRAKES																				
NONE																				
0.05 CALIBER (8)																				
FULL DIAMETER (8)																				
1-1/3 CALIBER LONG																				
STRAKES																				
NONE																				
0.05 CALIBER (8)																				
FULL DIAMETER (8)																				
1-2/3 CALIBER LONG																				
STRAKES																				
NONE																				
0.05 CALIBER (8)																				
FULL DIAMETER (8)																				
STABILIZER																				
NONE															●	●				
BALLUTE	●	●	●	●	●	●	●	●	●	●	●	●	●	●			●	●	●	●
3 CALIBER DIAMETER																				●
1-1/4 CALIBER DIAMETER						●														
1-1/2 CALIBER DIAMETER							●	●												
1-3/4 CALIBER DIAMETER									●	●										

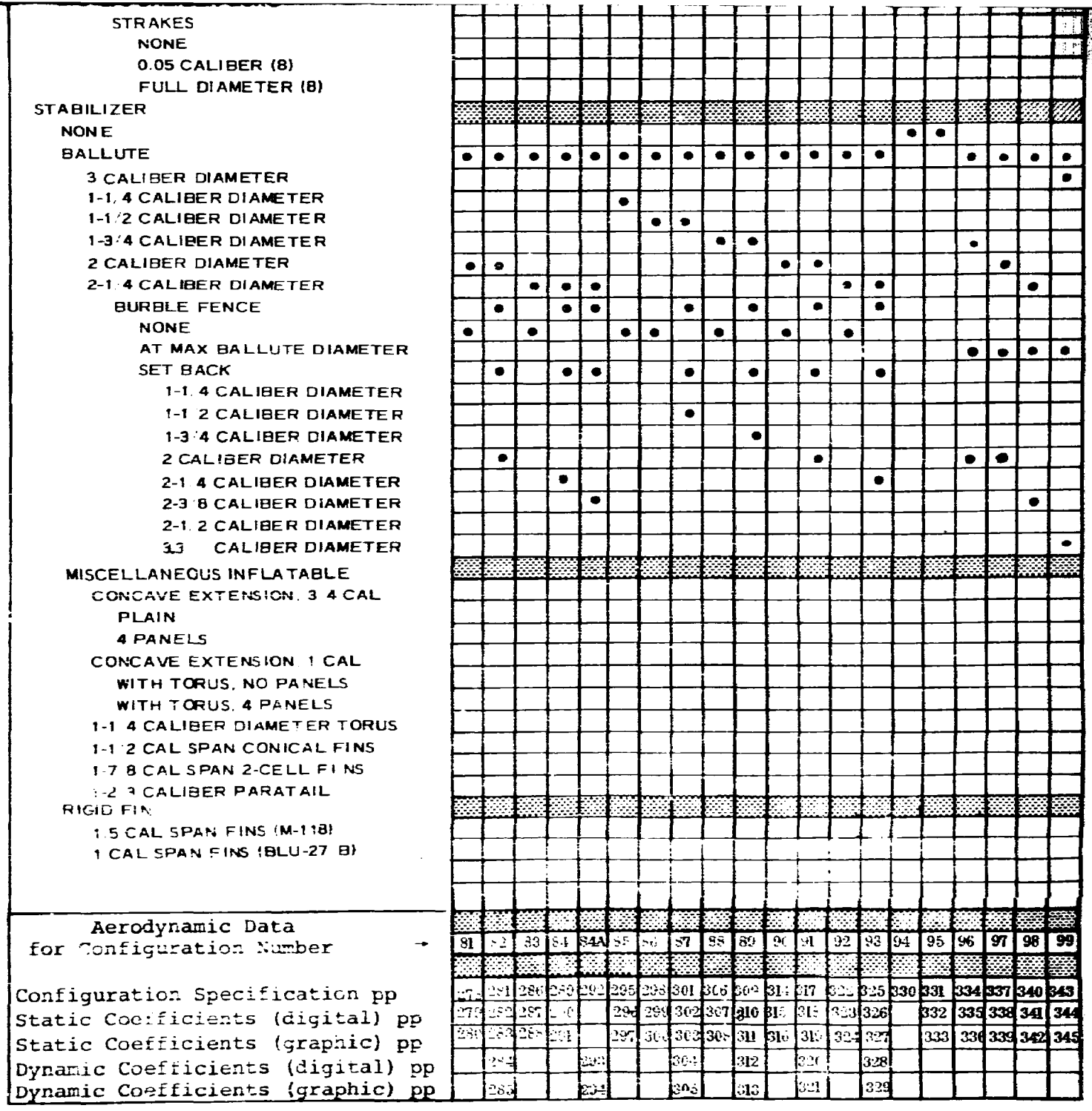

Figure 285. Configuration Characteristics Identification Index (Continued)

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MODEL CHARACTERISTICS	CONFIGURATION NUMBER																		
	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119
NOSE GEOMETRY																				
OGIVE	●	●														●				
1 CALIBER LONG	●	●																		
2 CALIBERS LONG																				
3 CALIBERS LONG																				
CONE																				
90 DEG																				
60 DEG																				
30 DEG																				
FLAT WITH 0.1 CALIBER RADIUS																				
PLAIN		-	●			●			●			●			●			●		
1.1 CALIBER TRIP RING				●			●			●			●						●	
HEMISPHERE					●			●			●			●			●			●
FINENESS RATIO (EXCLUDING INFLATABLE)																				
1 TO 4	●	●	●	●	●	●	●	●												
4 TO 6									●	●	●	●	●	●						
6 TO 8															●	●	●	●	●	●
8 TO 10																				
10 TO 12																				
AFTER SECTION GEOMETRY																				
1 CALIBER CYLINDER	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
1.1 CALIBER CYLINDER																				
BOAT TAIL																				
1 CALIBER LONG																				
STRAKES																				
NONE																				
0.05 CALIBER (8)																				
FULL DIAMETER (8)																				
1-1/3 CALIBER LONG																				
STRAKES																				
NONE																				
0.05 CALIBER (8)																				
FULL DIAMETER (8)																				
1-2/3 CALIBER LONG																				
STRAKES																				
NONE																				
0.05 CALIBER (8)																				
FULL DIAMETER (8)																				
STABILIZER																				
NONE																				
BALLUTE	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
4 CALIBER DIAMETER	●																			
5 CALIBER DIAMETER		●															-			
1-1/2 CALIBER DIAMETER			●	●	●															

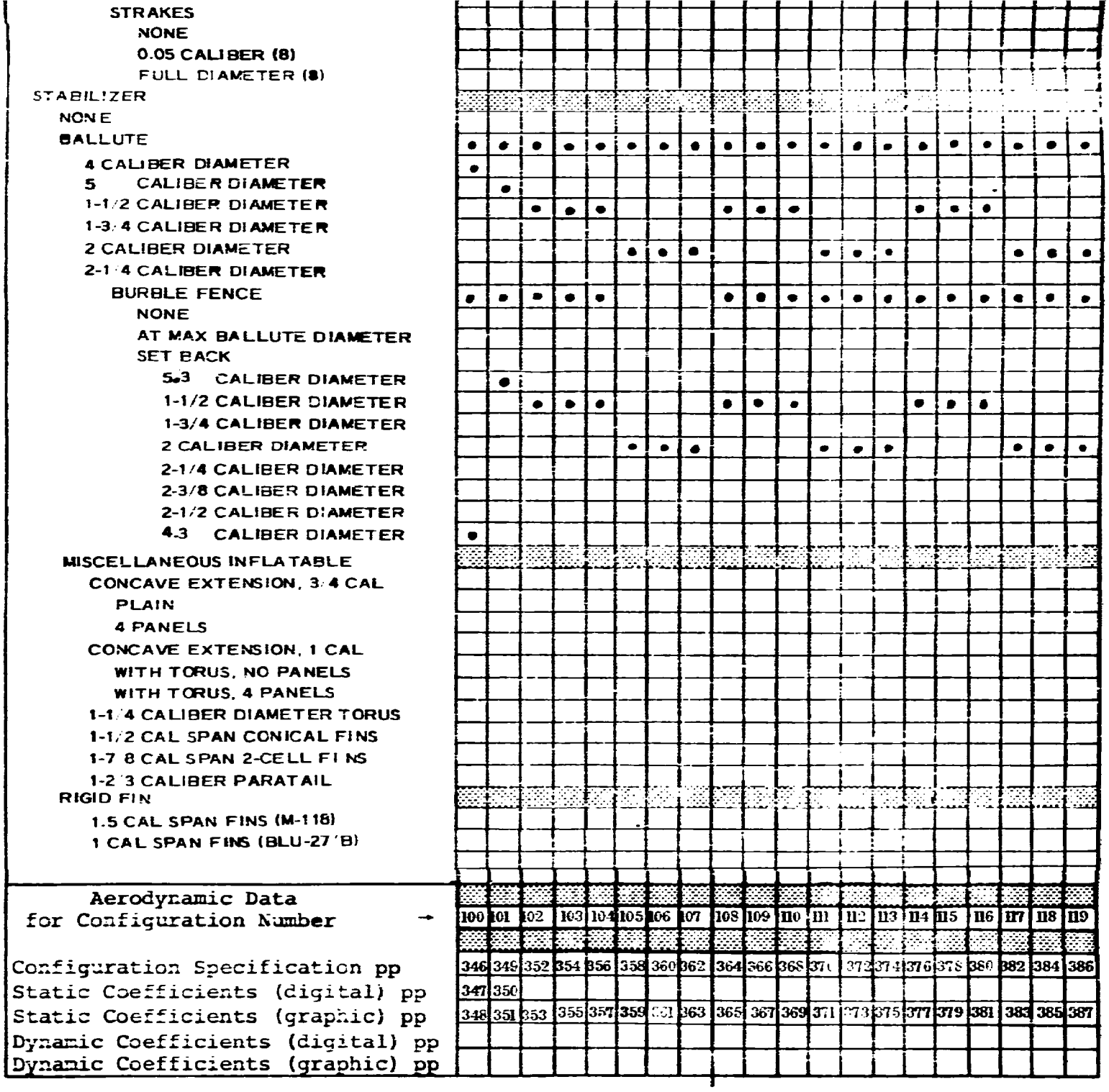

Figure 285. Configuration Characteristics Identification Index (Concluded)

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Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1 ORIGINATING ACTIVITY (Corporate author) Goodyear Aerospace Corp 1210 Massillon Road Akron, Ohio 44315	2a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED 2b. GROUP

3 REPORT TITLE

BALLUTE STABILIZATION FOR VARIOUS MUNITION CONFIGURATIONS

4 DESCRIPTIVE NOTES (Type of report and inclusive dates)

Final Report - 18 December 1969 to 30 April 1972

5 AUTHOR(S) (First name, middle initial, last name)

J. J. Graham

6 REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
April 1972	457	

8a. CONTRACT OR GRANT NO	9a. ORIGINATOR'S REPORT NUMBER(S)
F08635-70-C-0050 b. PROJECT NO. 670A c. Task No. 08 d. Work Unit No. 006	9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report) AFATL-TR-72-75

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Distribution limited to U. S. Government agencies only; this report documents test and evaluation; distribution limitation applied April 1972 . Other requests for this document must be referred to the Air Force Armament Laboratory (DLDL), Eglin Air Force Base, Florida 32542.

11 SUPPLEMENTARY NOTES	12 SPONSORING MILITARY ACTIVITY
Available in DDC	Air Force Armament Laboratory Air Force Systems Command Eglin Air Force Base, Florida 32542

13 ABSTRACT

One hundred and nineteen Ballute-stabilized bomb configurations were studied to determine the feasibility of ram air-inflated Ballutes as stabilizers or decelerators for various tactical missions. Both subsonic and transonic wind tunnel tests were conducted to define static and dynamic aerodynamic characteristics.

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14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Ballute Stabilization						
Ballute-Stabilized Bombs						
Bomb Decelerator						
Bomb Aerodynamic Characteristics						
Air-Deliverable Munitions Techniques						
Aerodynamic Data						